PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXVI. JULY TO DECEMBER, 1889. No. 130.

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☞ It is requested that the receipt of this number be acknowledged.

☞ In order to secure prompt attention it is requested that all correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

PUBLISHED FOR THE AMERICAN PHILOSOPHICAL SOCIETY
BY
MacCALLA & COMPANY,
NOS. 237-9 DOCK STREET, PHILADELPHIA.

EXTRACT FROM THE BY-LAWS.

CHAPTER XII.

OF THE MAGELLANIC FUND.

SECTION 1. John Hyacinth de Magellan, in London, having in the year 1786 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted); and the Society having accepted of the above donation, they hereby publish the conditions, prescribed by the donor and agreed to by the Society, upon which the said annual premiums will be awarded.

CONDITIONS OF THE MAGELLANIC PREMIUM.

1. The candidate shall send his discovery, invention or improvement, addressed to the President, or one of the Vice-Presidents of the Society, free of postage or other charges; and shall distinguish his performance by some motto, device, or other signature, at his pleasure. Together with his discovery, invention, or improvement, he shall also send a sealed letter containing the same motto, device, or signature, and subscribed with the real name and place of residence of the author.

2. Persons of any nation, sect or denomination whatever, shall be admitted as candidates for this premium.

3. No discovery, invention or improvement shall be entitled to this premium, which hath been already published, or for which the author hath been publicly rewarded elsewhere.

4. The candidate shall communicate his discovery, invention or improvement, either in the English, French, German, or Latin language.

5. All such communications shall be publicly read or exhibited to the Society at some stated meeting, not less than one month previous to the day of adjudication, and shall at all times be open to the inspection of such members as shall desire it. But no member shall carry home with

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ERRATA.

In List of Obituary Notices, on page 289, insert

PEALE, Franklin. (Robert Patterson). . . . . Procs. XI. 597

P. 459, line 12 from bottom, for *was held a second congress* lege "*was formed a second Society.*"

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The Holiday Customs of Ireland.

By James Mooney.

(*Read before the American Philosophical Society, May 3, 1889.*)

SYNOPSIS.

INTRODUCTION.—*Saint Bridget's Day*—Origin—One of the great pagan fire festivals—Sacred fire of Kildare—Brighid an ancient Irish goddess—The bairghean breac—The Brideog—The Crios Bhrighide—Gaelic and English verses sung—The crosses of rushes—Passing through the crios—Bringing home the rushes—Hebrides custom. *Saint Patrick's Day*—The national festival—Festivity the chief feature—Lover's account of the birth of Saint Patrick—Weather sayings—The croiseog—Processions—Drowning the shamrock. *Shrove Tuesday, Lent and Easter*—Shrove Tuesday, perhaps, the ancient festival of Beinid—Marriage season—Taking to Skellig—Tossing the pancake—Sruthan na ngadaraidhe—Cock throwing—Ash-Wednesday—Good-Friday—Strange fishermen's custom—Easter Sunday—Egs and bacon—The Easter dance—The dancing sun—Beliefs. *May-day or Bealtuine*—A universal ancient festival—The second of the Irish fire festivals—Kindling the new fire—Sacrifices—Passing through the fires—Ceremonies relating to cattle—The gilded ball—May Sunday in Cork—Bonfires and May-poles—Nettlemas night—Fire beliefs—The May-pole and May-bush—The rowan tree—The May dance—The May queen of Finglas—The May boys—Miscellaneous beliefs, cattle, witches, butter stealing—Fairy beliefs—Love charms—Repairing the fences—Settling the dues—Omens—An unlucky birthday—Easter derived from the May festival. *Whitsuntide or Cingcis*—Strange fatality in the season. *Saint John's Eve or Midsummer Night*—Ancient festival of the summer solstice—Universal festival of Modern Europe—Third great fire festival of Ireland—The bonfires—Origin of the word—The celebration in the north—Cattle ceremonies—The "white horse"—Fairy time—The celebration in the west. *Samhan, or Hallow E'en*—Origin—The last of the fire festivals—The great Feis of Tara—The modern celebration—The apple a

prominent feature—Ducking for apples—The snap apple—"Lamb's wool"—Festivities—Love charms and omens—Nut burning—The ten beans—Cabbage pulling—The three basins—Dream charms—Hemp seed—Winnowing—Tarruing na Sruith—The lime-kiln conjuration—Other mystic spels—Fairy travels—The Puca—The dead again upon earth—The celebration in Donegal. *Saint Martin's Day*—Origin—Unaccountable beliefs in connection with this saint—Drawing blood—Legends—Sprinkling and marking with blood—Legends of the origin of the custom—Belief in regard to the turning of wheels. *Saint Stephen's Day*—An ancient Keltic festival—Reasons given for hunting the wren—The wren, the king of birds—The wren boys—Carrying the wren—The custom unknown in the extreme north—Gaelic and English verses sung—English originals of some of them. *The Christmas Holidays, New Year and Twelfth-night*—Origin of the winter festival—Leading features common throughout Europe—The Yule festival—The mummers—Description of a company—Drawing blood on Christmas—The Christmas block and candle—The three-prongd candle on Twelfth-night—The twelv rush candles—Miscellaneous Christmas beliefs—Origin of New Year—Beliefs in connection with the day—The rain test—Twelfth-night—Water turned to wine—Weather predictions—A sacred season—End of the holiday period.

The world has grown so familiar with the stories of misrule, suffering and violence in Ireland, that we ar apt to forget that there is another side to the picture, and that every nation has a home life as wel as a political existence. The little every day cares and pleasures of the household, the merrymakings and social gatherings of neighbors, and the occasional holidays, make up the real life of a people, and he who is ignorant of these knows not the nation, however familiar he may be with the history of its kings and rulers, their battles, victories and defeats. The heroes of Gettysburg and Spotsylvania wer men who enjoyed a good dinner, or a quiet smoke after a hard day's work, as much as any of us, and, as boys, took fully as much delight in a Fourth of July celebration or a raid on a watermelon patch. The dreaded Moonlighter or the unspeakable Fenian wil walk as many miles to a country dance as ever did Carleton's rollicking Ned M'Keown, is just as anxious about the condition of the potatoes and the health of the pig, finds as much satisfaction in listening to a fiddler at a wedding or a story teller at a wake, and in his young days was just as eager in hunting the wren on Saint Stephen's day or feeding the bonfires on Saint John's eve.

What ar calld the popular customs of a nation ar always best preservd by the agricultural and village portion of the population, a class especially numerous in Ireland from the fact that the peculiar political conditions of the country compel the great bulk of the people to draw their living directly from the soil, leaving them but scant opportunity to acquire an education or to become familiar with modern progress. In spite of all this, however, the old customs ar decaying here as elsewhere,

and many of the observances which wer once general ar now confined to remote mountain districts or liv only in the memory of the older people, while others, again, ar stil common throughout the country. As there is but little communication amongst the peasantry of different districts, excepting at the fairs in the summer time, the customs common in one parish ar sometimes entirely unknown in another hardly ten miles distant. In this paper we shal describe the beliefs and customs connected with the observance of the principal Irish holidays, omitting those of lesser importance. As a number of these holiday observances ar more or less common to all the Aryan nations, especially to those of Western Europe, it must suffice to note the fact here without entering into a detaild comparison. The features more peculiarly Irish ar mainly derived from the old druidic worship. Where authorities ar not given, the statements ar the result of personal investigation. As a matter of convenience, all those customs which wer in use within the present generation ar described as stil existing, altho some of them ar now obsolete.

The essentially foreign customs found only in those districts—chiefly in the north—occupied principally by Scotch and English settlers, hav no place in this connection. Aside from these, however, many of the genuin Irish observances hav evidently been considerably modified by English influences. This is especially true of the May-day and Christmas celebrations, while in regard to the many holiday rimes it is hardly too much to say that they hav been imported bodily from England. The same may be said of many of the children's rimes, riddles and other formulas, even in the remote west where the Gaelic is the ordinary language of the people. This may be due in some slight degree to contact with the English colonists in Ireland, but by far a more efficient cause is to be found in the annual summer exodus of the Irish harvesters. As soon as the corn begins to ripen troops of the poorer laborers from every part of the country turn their faces toward Dublin and Queenstown, where, embarking by thousands, they cross over to Liverpool and range in small parties from one end of the country to the other until the harvest is over and cold weather approaches, when they return to their own land with a few pounds apiece to pay the rent and perhaps a few shillings extra to buy salt for the potatoes. During these summer months they mingle constantly with the rural English population, by whom the old customs ar most cherisht, become familiar with their habits, games and sayings, and enter into a friendly intimacy such as is never extended to those of the same race in Ireland, where they ar always regarded by the natives as foreign usurpers, and disliked and avoided accordingly.

Saint Bridget's Day, February 1.

The observances connected with New Year and Twelfth-night wil be described in treating of the Christmas holidays, of which these festivals form a part. Proceeding onward in the calendar the first great festival is that of Saint Bridget's day, February 1. The ceremonies in this case, as

in that of several other holidays, begin on the preceding eve, as among the ancient Irish the day was considerd to begin at sundown. This is a peculiarly Gaelic festival, and its observance under this name seems to be confined to Ireland and the remoter districts of Scotland; but there is every reason to believ that it was a part of a general European fire celebration, which stil survives in Candlemas, the second of February. In ancient Rome, as in Ireland, this festival was dedicated to a female deity, Februa, in whose honor the people carried burning torches about the streets just as the candles ar now lighted in honor of the Virgin Mary. In ancient Ireland the day now consecrated to Saint Bridget was the occasion of the first of the five great fire celebrations of the year, and it seems probable that bonfires were lighted then as on the eves of May-day and Saint John.

Saint Bridget was one of the earliest disciples of Saint Patrick, the apostle of Ireland, and founded a convent of nuns at Kildare in the year 484. This cloister, like that of the vestal virgins of ancient Rome, was celebrated for its perpetual fire, which was fed and guarded by the nuns, and which, with the exception of a short intermission in the thirteenth century, burnd constantly for more than a thousand years until the suppression of religious establishments by Henry VIII. It was permitted to blow this fire only with a bellows and not with the breath.* This remarkable incorporation of the old fire worship of the country into the service of a Christian saint, together with the fact that *Brig'id* (pronounced *Breej*) was the name of one of the deities of pagan Ireland, render it probab e that the ceremonies now practiced in honor of the saint ar but modifications of the ancient rites intended to propitiate the heathen goddess, who, from the character of the observances, would appear to hav been the special protectress of cattle and the dairy. This is the more likely as it is a wel establisht fact that almost every practice known to the holiday calendar of modern Europe had its origin in the pagan ceremonials of pre-Christian times. The date also corresponds closely with that of the first of the five great annual fire festivals of ancient Ireland. The lark is held sacred to Saint Bridget because its song used to wake her to prayers every morning, and if heard singing upon her day it presages good luck and fine weather.†

The Gaelic name of Saint Bridget's eve is *Oid'c'e B'rig'ide* (pronounced *Ekha Vreja*, or, incorrectly, *Eel Vreja*), "Bridget's Night." In the last century, according to Vallancey, it was customary on this occasion for every farmer's wife to bake a cake calld the *bairg'ean breac* (*bawran brac*) or spotted cake. The house was then set in order and the neighbors invited, the cake sent round with ale and pipes, and the evening was spent in mirth and good humor.‡ In the east and south-east young girls dress up the churn-dash to represent Saint Bridget, and carry it in procession

* Grimm, Mythologie, i, 578.

† Lady Wilde, ii, 121, 136.

‡ Vallancey, Collectanea (Ant. Ir. Lang.), ii, 291.

from one house to another, expecting to receiv a treat at each, and in this they ar seldom disappointed. In the city of Limerick, where, as may wel be supposed, the old custom has degenerated, a broom is drest up, not as the saint, but as "Miss Bridget."

In Galway and other parts of the west, companies of young girls carry about on this eve a figure known as the *Brideog* (*Breejoeg*), made of straw and rushes and drest to resemble the saint. At every house the carriers sing a short verse or two, and ar rewarded with a small gift of money or cakes, the net proceeds being expended by the participants in a jollification later in the evening. The young men, with their faces coverd with painted masks of paper, go about in like manner, singing verses and carrying a rope known as the *Crios B'rig'ide* (*cris Vreja*) or "girdle of Bridget," which wil be described later. The ends of this rope ar joind so as to form a circle, through which every one is expected to pass on payment of a small trifle. The Gaelic verse commonly used in Galway is as follows:

Crios B'rig'ide, mo c'rios,
Crios na d-tri g-cros.
Eirig' suas, a b'ean na tig',
Tab'air d'am rod-a cinnt 'sgo t'ri mo c'rios,
Agus go m-bud' seac't mile fearr b'eid'eas tu bliag'ain ó anoc'd.*

Which may be renderd literally:

Bridget's girdle, my girdle,
Girdle of the three crosses.
Rise up, woman of the house,
Giv me something and pass through my girdle,
And may you be seven thousand times better a year from to-night.

The English verse used in Eastern Galway runs thus:

God bless the master of the house,
  And the mistress also,
And likewise the little children
  That around the table grow.
Go down into your cellar,
  If anything you can find
Your pockets are not empty
  If to help us you'r inclined.
Your pockets are not empty
  Of money or strong beer (!)
And we'l trouble you no more again
  Until another year.

While this verse is wel known in East Galway, it is English in its origin and easily to be recognized as such, altho as here given it has receivd one or two unmistakable Irish touches. No genuin Irish popular song would ever bid the master go down into the cellar, such a thing being an

* Pronounced: *Cris Vreja, mo khris,*
Cris na jre grus.
Iree sus, a van a che,
Thoar um rudh a ceench sgú hre mo khris,
Ŏgus go mú shokhth meelya fár viee thu bleean o nukhth.

unknown appendage to the house of the ordinary farmer or peasant. In trying to avoid this incongruity farther on, by substituting the word pocket for cellar, the boys hav only made matters worse by filling the pockets aforesaid with strong beer. The original of the first four lines is the Yorkshire Christmas carol, as given by a writer of 1824 in the *Gentleman's Magazine:*

"God bless the master of this house.
The mistress also,
And all the little children
That round the table go."*

The remainder is probably taken from a verse given by Brand as sung by English children on All Souls' day, and much resembling another verse sung on Easter morning. The last lines of the former ar as follows:

"Put your hand in your pocket and pull out your keys,
Go down in the cellar, bring up what you please,
A glass of your wine or a cup of your beer,
And we'll never come Souling till this time next year."†

According to O'Reilly's "Dictionary," the Brideog is used by girls on the eve of the saint to determin who shal be their future husbands,‡ which is the only hint the writer has receivd thus far of its use as a love charm. The Brideog is unknown in the north and in the south-west, but in both sections, as wel as in Galway and throughout the greater part of Ireland, it is customary to hang up about the walls of the house numbers of small crosses made of straw or rushes. In Galway these ar made, at least in part, of materials taken from the Brideog after it has servd its original purpose in the procession. In the ordinary cross each arm is made of three strong rushes or straws, converging at the ends and widening out in the centre of the cross, where they ar interwoven. In Kerry a more elaborate cross is sometimes made of wood, about 5 x 8 inches in length. Short crosspieces ar fastend near each end so as to make four smaller crosses, around each of which is brought a single rush or straw in diamond fashion, while a similar larger diamond is fixt around the centre of the cross. Should a Kerry farmer hav a firkin of butter on hand as spring approaches, he wil defer opening it until this day.

The *Crios Brigide* or "Girdle of Bridget," already mentiond, plays an important part in these ceremonies in the western districts. This is a rope made of green rushes, procured the day before, or if rushes be scarce, it is made of straw, with three green rushes plaited into it. The rope is made sufficiently long to allow a tall man to pass through the circle without difficulty when the ends ar joind together to form the girdle. It is made on Saint Bridget's eve, and as soon as the ends of the rope hav been joind, the master of the house holding it doubled up in his right hand, makes the sign of the cross with it in the name of the Trinity

* Pop. Sup., 94.
† Brand, Antiquities, i, 413.
‡ Edward O'Reilly, Irish-English Dictionary, new ed., n. d., Dublin, under *Brideog*.

and passes it three times from right to left around his body. Then holding it out at arm's length in his right hand, he lets one end drop so as to form a circle, through which he passes three times, putting the right foot through first each time. He then doubles up the rope and again passes it three times around his body as at first. He is followd in turn by every member of the family. In some cases the girdle is simply laid on the floor in the shape of a circle and each one passes through it by lifting up one side to step under, and then raising the other side to step out again. In the morning—Saint Bridget's day—the girdle is hung over the stable door and all the animals ar made to go through it. This ceremony protects both men and animals from the influence of evil spirits throughout the year. In some cases the rope is kept in the family from one recurrence of the festival to another. A rush taken from it and tied about the head wil keep the headake away from the wearer for a year.

In different parts of the country there ar several interesting ceremonies in connection with bringing home the rushes, which ar procured on the day preceding the festival. In Galway, the boys go in the morning to the small streams in the neighborhood and gather bundles of the green rushes. In the evening—the eve of the festival—these ar brought around to each house, which, in every instance, is found with the door tightly closed, the family being waiting in silence within. Going up to the door, the boys shout seven times, "*Leig asteac' Brig'id*" (*Lig aschŏkh' Breej*), "Let Bridget enter," while to each demand those within reply, "*Leig a's cĕad fáilte rom'ad*" (*Lig os caedh fawlcha roath*), "Enter and a hundred welcomes before you." The door is then thrown open and the boys come in and leav some of their rushes, for which they ar rewarded with a small treat, after which they go on to the next house. Occasionally, some families get their own rushes.

In Donegal, the bringer of the rushes is a girl, who is calld *Brig'id* for the occasion, and it is seldom that a family of girls is without one of this name to enact that part in the ceremony. The rushes having been previously left at some convenient spot outside, Brighid goes out after dark and the door is at once closed after her. Taking up the bundle of rushes, she approaches the house and goes all around it, seeking an entrance, while those inside affect great terror and observ the strictest silence. On getting around to the back of the house, she sings:

Guid' me air mo g'luna,
Agus deoirid' go mo súile,
*Agus leig a-teac' Brig'id.**

I implore on my knees
And with tears in my eyes,
And let Bridget within.

* Pronounced in Donegal, somewhat incorrectly: *Gú mae er mo ghluna,*
Ŏg.us dherdhe go mo suila,
Ŏgus lig aschokh' Breej.

on which those inside shout gladly, "*Sí b'eat'a, sí b'eat'a, sí b'eat'a*" (*she văha, she văha, she văha*), "She's welcome, she's welcome, she's welcome," and, the door being opend, Brighid enters and deposits her rushes on the floor. According to a writer of 1716, a somewhat similar custom formerly existed in the Hebrides, where a sheaf of oats was drest as a woman and laid in a cradle known as "Brighid's bed," while the people shouted, "Brighid is come, Brighid is welcome."* This ceremony is, probably incorrectly, assigned to Candlemas, the day following Saint Bridget's day.

In the west and south a handkerchief, known as the *Brat Brig'ide* (*Broth Breja*), or "veil of Bridget," is left out over night on the saint's eve, and when saturated with dew in the morning is used to cure calvs of a diseas known as *ruatt'ar pêiste* (*roehar paeshcha*), or the "depredation of the worm," by striking them with it three times in the name of the Trinity.

Saint Patrick's Day, March 17.

Altho Saint Patrick's day is pre-eminently the Irish national holiday, not much can be said of it in a descriptiv way, as the observances connected with it hav but little of the old ceremonial or mythologic character. Processions and speeches in the larger towns and smaller gatherings in the country villages, with the assistance of the pipers and fiddlers in the evening, fil out the day, while every one seems bent on carrying out to the letter the spirit of the old ballad which declares that

"Saint Patrick's day we'l be all very gay."

The festival commemorates the apostle and patron saint of Ireland, this day, according to most writers, being the anniversary both of his landing in Ireland and of his death, the latter occurring in the year 493. That typical Irish poet, Samuel Lover, by turns so humorous and so pathetic, gives the following characteristic account of the origin of the celebration :

The Birth of Saint Patrick.

On the eighth day of March it was, some people say,
That Saint Patrick at midnight he first saw the day,
While others declare 'twas the ninth he was born,
And 'twas all a mistake between midnight and morn ;
For mistakes will occur in a hurry and shock,
And some blamed the baby, and some blamed the clock,
Till with all their cross-questions, sure no one could know
If the child was too fast or the clock was too slow.

Now the first faction fight in old Ireland, they say,
Was all on account of Saint Patrick's birthday.
Some fought for the eighth—for the ninth more would die ;
And who wouldn't see right, sure, they blackened his eye!
At last both the factions so positive grew
That each kept a birthday, so Pat then had two ;
Till Father Mulcahy, who showed them their sins,
Said, "No one can have two birthdays but twins."

* Martin, "Account of the Western Islands of Scotland," quoted in Brand, Antiquities, 50.

Says he, "Boys, don't be fightin' for eight or for nine;
Don't be always dividin'—but sometimes combine;
Combine eight with nine, seventeen is the mark,
So let that be his birthday." "Amen," says the clark,
"If he wasn't a twin, sure our history will show
That, at least, he's worth any two saints that we know!"
Then they all got blind drunk, which completed their bliss,
And we keep up the practice from that day to this.

It is a saying among the people that after Saint Patrick's day it is time to begin to make garden. In Connemara they say that one should hav half his farm work done by this time and half his fodder stil on hands, and that after this every alternate day wil be clear and sunshiny. The weather on this day is proverbially fine, and of course there is an Irish reason for it. In the first days of Christianity in Ireland Saint Bridget was much hinderd in her work by the rains, which ar especially frequent in this country, until at last she obtaind as a favor from God that every other Sunday should be a clear day, so that she might preach to the crowds which came to hear her. Not to be outdone, Saint Patrick askt that his anniversary might be a day of sunshine, which was granted, and from that time forth the 17th of March has always been a fine day.*

On this day every child throughout Ireland, excepting in Connemara and some of the northern districts, is expected to wear upon the left breast a small disk intersected by crosses upon the surface and known as a *croiseog* (*crishoeg*) or "favor." In Connemara the croiseog is worn only by the women. They ar of various designs and colors, but the general pattern is everywhere the same. The disk is made of stiff paper, or of silk lined with pasteboard, and across the surface ar pasted strips of paper of different colors, crossing each other at right angles, so as to form some even number of crosses having a common centre in the middle of the disk. These strips ar sometimes cut so as to giv the arms of the cross an elliptical shape. Around the edge of the disk, between the arms of the crosses, ar drawn small arcs which ar fild in with dots, shamrocks and other figures, in ink of various colors. The ends of the crosses ar sometimes trimd with ribbons. In Clare and Connemara there is usually but one cross, which is drawn upon the surface of the disk with the blood of the wearer, the blood being obtaind by pricking the end of the finger. The green is usually procured from grass and the yellow from the yolk of an eg.

At the merrymaking, in the evening, no good Irishman neglects to "drown the shamrock" in "Patrick's pot"—in other words, to dip the shamrock in a glass of whisky. After wishing the company health, wealth and every prosperity, including "long leases and low rents," he dips the sprig of shamrock into the liquor which he is about to drink and then touches it against another, which he wears in his hatband in honor of the day. It is hardly necessary to state that the shamrock is a small variety of clover and the national emblem of Ireland. According to the popular

* Lady Wilde, II, 121, 122.

belief, its adoption as the national ensign dates from the time when Saint Patrick used it to explain to the pagan Irish the mystery of the Trinity, or three in one. In East Galway and adjacent parts, the processions on this day carry banners bearing representations of incidents in the traditional life of Saint Patrick, such as the baptism of Oisin, the banishing of the snakes, etc. Everywhere men wear the shamrock in their hatbands, while women and children fasten it in their hair or upon their breasts.

Shrove Tuesday, the Lenten Season and Easter.

The customs pertaining to the Lenten season, with the attendant festivals of Shrove Tuesday, Good-Friday and Easter, may properly be treated together, and as they ar based upon ideas which ar in great part the common heritage of Christian Europe, they vary but little in the different countries. The first festival of this season is *Shrove Tuesday*, or as it is calld in the eastern and northern districts, Seraf' Tuesday. This feast, like the others pertaining to Lent, is movable, but generally occurs toward the close of February, thus corresponding with the old pagan feasts of Bacchus and Pan—the Bacchanalia and Lupercalia—of which Shrove Tuesday is probably the modern descendant. From its Gaelic name, *Inid* (*Inij*), Smiddy argues that it may correspond in Ireland with the ancient festival of Beinid, the Minerva of the pagan Irish.* The Roman feast of Minerva took place about the middle of March, and was celebrated by public amusements, and was also a favorit time for getting married. This statement stil holds good throughout all Catholic countries, where marriages ar prohibited by the Church during the succeeding six weeks of Lent. On this subject the same author says: "It is also remarkable that in the Irish-speaking districts more marriages take place at this season than at any other period of the year. The feasts and the marriages are at present ascribed to the near approach of the season of Lent; but perhaps, like the other popular festivities of the year, they had their origin in something more remote, though now forgotten."† Back of all mythology the custom probably has its explanation in the fact, as stated by the poet, that

> "In the spring the young man's fancy lightly turns to thoughts of love."

It is popularly expected that all the marriageable young folks shal hav been mated before Lent, and on this, the last day of grace, the young men in Cork, Waterford and other towns of the south, wer formerly accustomd to go through the streets in bands, carrying ropes, with which they caught any unlucky girl who had "mist her chance," and pulld her a few rods along the road, after which she was releast. This was calld taking her to Skellig to get married, the allusion being to the Skellig rocks on the coast of Kerry, formerly a noted place of pilgrimage, toward the end of the Lenten season, for young women who desired good husbands. This "taking to Skellig" has supplanted an older and rougher pastime,

* Smiddy, Druids, 112.
† *Idem*, 112-3.

practiced in the south about fifty years ago and known as "drawing the log." Any unmarried young folks of either sex who wer so unfortunate as to be caught on the streets on this day wer compeld to drag a heavy timber at the end of a rope, followd by crowds of men and boys armd with shillelaghs and shouting, "Come draw the log, come draw the log," while keeping step to the music of a piper in attendance. In Hall's "Ireland,"* this custom is assigned to the following day, Ash-Wednesday, which is obviously a mistake.

In Clare, it is said that all the disappointed young women—and, for that matter, the disappointed young men as wel—ar in a bad humor on Shrove Tuesday night, and their soreness continues to increase all week, so that by Sunday they can be distinguisht by the "puss" on their countenances. Hence, the first Sunday in Lent is there known as "Puss Sunday," and mischievous boys delight in marking the backs of the unfortunate ones with flour or chalk so as point them out to the whole congregation. This practice exists also in Kerry, where there is a popular legend that on the night of Shrove Tuesday, all the disappointed lovers of both sexes shoulder their burden of wasted hopes and blighted affections under the form of a bundle of gads or rods and repair to the banks of a mystic river, known, on this account, as *Srut'án na ngadaraid'e* (*srûhawn na ngŏdherĕ*), or the "stream of the gads," where they get rid of their troubles by throwing the whole load of affliction into the water. Going to *Srut'án na ngadaraid'e* is the Kerry equivalent for going up Salt river.

In the evening, the young folks—and the old ones as wel—gather round the turf fire to learn, by "tossing the pancake," what is to be the result of their future marriage ventures. A crock of batter having been prepared, a part is pourd out on the pan to form the first cake, which is consignd to the care of the oldest unmarried daughter. At the proper time, she turns the cake with a dextrous toss up the chimney, and if it comes down smoothly on the other side in the pan, she can hav her choice of a husband whenever she likes. If, on the other hand, it falls into the ashes or comes down with a corner doubled over, she cannot marry for at least a year. This is also regarded as an omen of il fortune with an accepted lover, and so strong is this feeling that engagements hav even been broken off for no other reason. The lucky tosser of the first cake at once shares it with the other girls. On eating it there is generally found in one slice the mother's wedding ring and in another a piece of furz, both having been put into the batter before baking. Whoever gets the ring wil be most happy in her future choice, while the other wil remain unmarried. A similar custom exists in England and Scotland.

The cruel custom of cock throwing on Shrove Tuesday, which stil exists in England, was formerly known also in Ireland, but is now extinct.† A cock was tied by the leg to a stone or stick, and every person who paid the small sum demanded was allowd to throw at it from a certain distance,

* Hall, Ireland, i, 315.

† *Ibid.*

the one who kild the bird being permitted to take it home with him. There is evidence to show that this custom originated in England, and was probably intended at first to giv expression to the national hatred for the French, a cock and a Frenchman having in Latin the same name, *Gallus*.*

Little need be said of *Ash Wednesday*, rendered literally in Gaelic by *Cedín a Luaitʳidˢ* (*Cĕdheen a Luaree*). In accordance with the general custom, it is observd as a day of solemn devotion. The ashes consecrated in the church upon this day ar preservd with religious care as a safeguard against evil influences, and with this intention mothers sometimes make the sign of the cross with the sacred ashes upon the foreheads of their new-born infants. In Ireland, as in all Catholic countries, branches of palm, or some evergreen substitute, ar worn in the hat or upon the breast on Palm Sunday.

Good-Friday, in Gaelic *Aoine Ceasdadˢ* (*Ena Caesdhu*), or "Crucifixion Friday," is also of but secondary importance in regard to any popular customs connected with it, altho one of the most solemn festivals of the Church. It is a day of prayer and rigid fasting, and in some parts of the country even infants ar not allowd the breast unless they cry three times for their accustomd nourishment. Brand states that it was formerly customary for women to go along the roads with bare feet and disheveld hair in imitation of Christ's sorrowful journey to Calvary.†

It is said that an eg laid on Good-Friday wil keep good until that day twelv-month. The same belief is held in England and on the continent in regard to bread baked upon this day. It is also customary to cut the hair upon Good-Friday in order to cut away the sins of the past year and begin a new life with the coming Easter, and any one doing so wil hav no headake for a year thereafter. Among the west coast fishermen of Connemara there exists the strange and barbarous practice of bringing home on this day living fish, which ar afterward fried alive.

Easter Sunday is the festival of colored egs in Ireland, as wel as elsewhere in Europe and America, the eg being an ancient symbol of the resurrection. Egs and bacon form the principal Easter dish, to which, in Roscommon and adjacent districts, there is added a cake, with a dance in the evening. According to an old writer, quoted in Brand, the egs and bacon wer formerly prepared, in the central districts, late the previous evening, but not toucht until the cock crew. The company then clapt hands with shouts of "Out with the Lent!" and made merry a short while before going to bed.‡

Piers thus describes the Easter festivities in Westmeath, in 1682: "On the feasts of Easter and Whitsuntide, the more ordinary sort of people meet near the ale house in the afternoon on some convenient spot of ground and dance for the cake; here, to be sure, the piper fails not of diligent

* See Pop. Sup., 310, 311.
† Brand, Antiquities, i, 152.
‡ *Ibid.*, i, 161.

attendance. 'The cake to be danced for is provided at the charge of the ale-wife, and is advanced on a board on the top of a pike about ten feet high; this board is round, and from it riseth a kind of a garland, beset and tied round with meadow flowers, if it be early in the summer; if later, the garland has the addition of apples set round on pegs fastened unto it; the whole number of dancers begin all at once in a large ring, a man and a woman, and dance round about the bush, so is this garland call'd, and the piper, as long as they are able to hold out; they that hold out longest at the exercise win the cake and apples, and then the ale-wife's trade goes on." *

If any one who has kept the Lent wel wil rise early on Easter morning, he wil be able to see the sun dance in the sky for joy at the resurrection, altho some persons assert that the sun givs but three leaps on this occasion. A favorit method is to observ the reflection in a wel or stream of water. In Kerry, the fish ar said to be asleep on this day, and the old people declare positivly that they can easily be caught with the hand in shallow water. In Meath, the day is held so sacred that it is said, that if one should black his shoes in the morning and then rub the brush against a tree, the tree would be dead before that day twelv-month. More wil be given in this connection in speaking of the next festival.

May-day or Bealtuine, May 1.

The next great festival is May-day, the first day of May, which, being generally regarded as the beginning of summer, has been observd as a holiday throughout Europe and in many parts of the Orient from the most ancient times. In Rome the feast of Maia was held upon this day and was preceded by the Floralia, lasting four days and celebrated in honor of Flora, goddess of fruits and flowers. It is probable that the ancient Irish festival also lasted several days, as in Gaelic Scotland the Bealtuine period is stil considerd to extend from the first to the eighth of May.† The old Scandinavians observd the day with feasting and dancing and a mock fight between winter and summer.‡ The ancient Persians celebrated the festival upon the 21st of April, when every fire was extinguisht, to be relighted with sacred fire from the temples.§ The essential features of this modern celebration, as wel as the beliefs connected with the day, vary but little throughout Europe, the festivities consisting chiefly of dancing around bonfires, or poles decorated with flowers and ribbons, while the omens relate to the prosperity of the dairy or the wedded lot of the girls. Certain trees ar held particularly sacred in connection with these observances, the May-pole being of oak in England, an elm in Cornwall and a birch in Wales,‖ while in Ireland the chosen tree is the *crann-*

* Piers, Westmeath, 123.
† See note in Pop. Sup., 51.
‡ Brand, Antiquities, i, 222.
§ Lady Wilde, i, 194.
‖ Brand, Antiquities (quoted), i, 236–7.

caoran (*crawn-ceeran*), the rowan or mountain ash. The May season, and especially May eve, is universally regarded as a favorit time for fairy revels and witches' spels.

The Gaelic name of May-day is *Lā Bealtuine* (*Law Bâvlthinny*), "the day of the Beal fire," Beal being the fire god of the Keltic nations and almost identical with Baal or Bel, the sun god of the Phœnicians and Assyrians. The month itself is calld "the month of Bealtuine." The pagan Irish wer fire worshipers, and this was one of the five great fire festivals of the year, the others being celebrated respectivly at the beginning of spring—about Saint Bridget's day; at midsummer on Saint John's day; at Lughnas or the beginning of August, and on the first day of November, the celebration in each case beginning on the preceding eve, as already stated. Fire stil holds an important place in the May-day and midsummer festivities, and Grimm states that in Wales, where a Keltic language is yet spoken, the "holy fires" ar also lighted on the first of November.*

The worship of fire and of its glorious embodiment, the sun, was a form of religious belief at once so ancient and universal that the subject need not be here discusst. The system probably attaind its highest development and greatest splendor in Persia in the east and in Ireland in the west, and in both countries, as wel as elsewhere, an impressiv ceremony of the ritual was the simultaneous extinction of every hearth-fire throughout the land, to be rekindled from the new fire solemnly lighted by the priests of the sun.

In Ireland the great festival of the new fire took place on the eve of Bealtuine, and the first fire was kindled by the druid priests either on the hil of Uisneach, which occupied a central position in the kingdom, or upon the hil of Tara, where stood the royal palace of the monarch.† Both hils ar in the county Meath. As soon as the blaze appeard above the trees other piles wer lighted on the surrounding hil-tops, until in a short time the circle of fire ran round the whole island. Death was the penalty for lighting a fire before the great one was kindled by the druids in Meath. Smiddy, who has investigated the druidic religion to some extent, is inclined to think that this new fire was procured from the rays of the sun by some simple mechanical apparatus, but as the ceremonies took place at night, it is difficult to see how it could hav been obtaind in this way, unless the fire was actually lighted before darkness came on, which does not appear to hav been the case. It is more probable that fire was obtaind by the friction of two pieces of dry wood, the method still in use among primitiv peoples, and often retaind in religious ceremonials after it has been superseded in every-day life by some more convenient invention. The particular method used was probably the twirling of a stick in a solid block or wheel of wood until sufficient heat was produced to ignite the

*Grimm, Mythologie, 1, 580.

†Smiddy (Essay on the Druids, 97) favors the first location, while other writers think Tara more probably the true one.

tinder placed at the point of contact. This was the process used by the Roman vestals, by the ancient priests of India and by their modern Brahmanic successors, and has even been practiced in the western islands of Scotland, one of the last sanctuaries of druidism, as late as 1767, in order to procure sacred fire with which to check a murrain amongst the cattle.*

According to Smiddy, as soon as the new fires wer blazing on every hil, "Feasts and sacrifices followed. Victims were given to the flames, and among them probably were included human beings. As on all other occasions of prayer and sacrifice, both priests and people placed themselves at the west of the fires, with their faces turned to the mystical and magical east. Most probably these ceremonies took place at an advanced hour of the night and were continued till morning, when the sun, the great form of Beal, appeared in his glory above the horizon. * * * It is stated that from the fires lighted by the druids on this solemn occasion the people carried home burning brands or live embers, with which to rekindle the domestic hearths, and that the seed of it, *siol na tinne*, was preserved and continued among them till the next anniversary of Beiltinne again. * * * The druids believed that in this way they kept the sacred fire of Beal perpetually burning and that great were the benefits which their people derived from its presence and influence among them. Even the fields at this season received portions of it to ensure a fruitful year and an abundant harvest."†

The great ceremony of Bealtuine was intended especially to bring a blessing upon the crops and herds, and it is stated by some authors that both human beings and cattle wer offered as a sacrifice to the fire upon this occasion. It is certain, at least, that two fires wer built close together and that men and cattle past between them, the purpose being to ward off the influence of disease.‡ In the last century the cattle wer stil driven through the May fires to preserv them from all disorders during the year,§ while the existing May-day beliefs concern themselvs chiefly with the safety of the milk and butter. The cardinal points derive their Gaelic names from the position assumed by the druids and people when paying the ancient homage to the rising sun. As the priest stood facing *soir* (*ser*), "the bright" place, his right hand was to the south, his left hand to the north and his back was turnd to the west. The Gaelic names for south, north and west ar *deas*, *tuaigh* and *iar* (*jäs*, *thuee*, *eer*), signifying respectivly, right hand, left hand and behind.

It is said that Saint Patrick first arrived in the neighborhood of Tara on the night when the people had assembled from all parts of the royal plain of Meath to celebrate the great Bealtuine, which, as it so happend, occurd this year upon the eve of Easter, and that the first intimation of the

*Grimm, Mythologie, i, 574–5; see also Kelly, Folk-lore, in his chapter on "The descent of fire."

†Smiddy, Druids, 94–7.

‡Cormac (A. D. 908), noted in Grimm, Mythologie, i, 580.

§Vallancey, Collectanea, ii, 276.

presence of the saint was given by the appearance of the blaze which he had kindled upon the adjacent hil of Slane in order to celebrate the offices of the Christian festival. In angry surprise the monarch askt who had dared to light that fire at a time when even the palace itself was in darkness, and receivd for answer from his druid that a stranger who revered not their ancient gods had kindled the fire, which, if not extinguisht that night, would burn on forever. Thereupon the saint was summond into the presence of the king, before whom he was examind, but, despite the warning of the druid, he was permitted to continue in the work which finally resulted in the overthrow of fire worship in Ireland.

The midsummer fires stil burn brightly, but those of Bealtuine ar nearly extinguisht, which is probably due to the fact that on the introduction of Christianity the old celebration was superseded by that of Easter, when the ceremonies took place by day, thus rendering bonfires out of place. Moreover, as Easter is a movable festival, never occurring on the same day in consecutiv years, it would become more and more difficult, under the new system, for the people to keep up the old accustomd periodic celebration. Within the last fifty years the May fires wer stil common throughout the south and east, and a Galway correspondent states that they wer also lighted around Lough Corrib in the extreme west, but they ar now confined chiefly to the counties of Limerick and Cork. The people gatherd together with fiddlers and pipers to dance around the blaze as on Saint John's eve, and when the fire had burnd low the cattle wer driven through it to keep them from all sickness until the next May-day. In Kildare, in addition to the bonfire, a May-bush was set up and decorated with lighted candles. In the adjacent county of Meath the custom is now unknown, but seems to hav been practiced at an earlier period. In the County Limerick the fires ar stil lighted as on Saint John's eve and the cows ar sprinkled with holy water and burnd with blessed candles and with blazing branches of white or black thorn from the pile, in order to keep them in health and insure plenty of milk and butter during the year.

Another old May-day custom is thus described as it existed in the south nearly a hundred years ago. The gilt ball mentiond was probably at one time a mystic symbol of the sun: "On the 1st of May all the young men assemble in their several districts, and go in procession, dressed out in ribbons, garlands, etc. The leader bears on a pole a double circle of hoops, in the centre of which hangs a gilt ball. They call at every house where a marriage had taken place since the last May-day. The new-married lady, together with a pecuniary present, presents another ball, which is, like the former, elevated on another pole. This last ceremony is only practiced in the south of Ireland."* This custom is described in Hall's "Ireland" (i, 167), already quoted, as stil existing about forty years ago, altho then nearly obsolete, and it is also stated that the May-pole carried was a tall tree, which was set up in front of the door, and around which the party danced in honor of the bride.

* E. W., quoted in Pop. Sup., 55.

In the city of Cork the celebration is held on "May Sunday," the first Sunday of May, perhaps because the working people ar then more at leisure. For some nights beforehand parties of young men make secret forays upon the demenes of the neighboring gentry in order to secure tall, straight-growing oak trees, which ar cut down and trimd off to serv as May-poles. These ar then carried into the town and set up in every convenient gathering place throughout the city. The poles ar as high as a tall flag-staff and ar firmly planted in the ground, but not decorated in any way. The work must all be done by night, as the whole business is an offense against the peace and dignity of the law, which woodrangers and police consider it their bounden duty to prevent. There seems to be a tacit understanding that the sports shal not be interfered with after the poles hav been set up. On the evening of May Sunday small parties collect and proceed toward their respectiv poles, with numerous tar-barrels placed upon doors which ar borne upon the shoulders of the men, while on other doors carried in the same way ar placed chairs in which ar seated a piper and fiddler. With music playing and shouts and laughter ringing out on the air, they march in this fashion to the pole, and, on reaching it, the barrels ar piled around its base, together with a plentiful supply of turf. The musicians ar then installd on a temporary throne, the pile is lighted and the dance begins, to last until daybreak. Parties from different poles pay mutual visits to each other during the night, each party headed by a musician, and dance three times around the pole of the party visited. As the poles ar green they ar but little injured by the fire and ar afterward cut down by those who procured them and sold for a few shillings apiece, the proceeds being spent for drink or other refreshments. A small collection is also taken up outside the church in the morning to pay the musicians.

Another May eve observance in this city is thus described as it existed forty years ago: "Another old custom prevails also to some extent. May eve, the last day of April, is called 'Nettlemas night;' boys parade the streets with large bunches of nettles, stinging their playmates and occasionally bestowing a sly touch upon strangers who come in their way. Young and merry maidens, too, not infrequently avail themselves of the privilege to 'sting' their lovers; and the laughter in the street is often echoed in the drawing-room."*

Fire is held sacred in Ireland, and there ar a number of May-day beliefs connected with it. None wil be given out of the house on this day for any consideration, as such an act brings all kinds of il fortune upon the family, and especially enables the borrower to steal all the butter from the milk, so that any one who should ask for the loan of a lighted sod of turf on May-day would be regarded as a suspicious character, whom it would be just as wel to watch. To giv out either fire or salt on this day is to giv away the year's luck. One old writer states that fire would be given only to a sick person, and then with an imprecation, but the butter,

*Hall, Ireland, i, 25.

if stolen, might be recoverd by burning some of the thatch from over the door. In the city of Limerick the fire is always lighted by the man of the house on May morning, as it is unlucky to hav it done by a woman.

According to Lady Wilde, "If the fire goes out on May morning it is considered very unlucky, and it cannot be rekindled except by a lighted sod brought from the priest's house. And the ashes of this blessed turf are afterwards sprinkled on the floor and the threshold of the house."* The same author asserts that milk is also pourd on the threshold, and that if a traveler should ask for a cup of milk he must drink it in the house, and with a pinch of salt in it, for no fire, water, salt or milk must be given out on this day.

Owing to the scarcity of timber the May-pole has long since disappeard from Ireland, excepting in a few isolated districts, chiefly in the south, altho it was once known to all Keltic countries, and was found in Britain as early as the Roman invasion. At Maghera, in the extreme northern county of Derry, the May-pole was annually planted in the market place until 1798.† The custom has even been carried across the Atlantic by the emigrant French, and "*un mai*" is frequently planted on the shores of the Saint Lawrence in honor of some local celebrity.‡ The tree or pole decorated with garlands was an appropriate symbol of the spring, and the peculiar dance around it may hav had some reference to the circuit of the sun in the heavens. In Ireland and in Gaelic Scotland the dancers always follow the course of the sun from right to left, and one who takes the contrary direction is quickly told to "dance with the sun." Two hundred years ago, in districts where timber was plentiful, tall poles wer set up on May eve, and allowd to stand nearly the whole year, while in front of every door was placed a green bush decorated with yellow flowers (buttercups?). §

The May-bush, trimd with flowers, is stil more or less general throughout the country, especially in the south. In Meath, in addition to setting up the May-bush, the children formerly strewd flowers in front of the doorway, while in Kildare, as already stated, the bush was decorated at night with lighted candles. In Clare, Galway and other parts of the west, a branch of the rowan tree (*crann caoran*) is put over the doorway or planted in front of the house, and is known as the *Cráinín Bealtuine* (*Crawnyeen Bawlthinny*) or "little May-tree." In some mysterious way the crann caoran has power against all spels of witches or fairies, who ar uncommonly active on May-day, for which reason branches of the tree ar put in the haggart or in the fields on this occasion, while smaller twigs ar twisted around the churns and milking vessels, to protect the crops and the butter. The same custom, as it exists in Sweden and Germany, is

* Lady Wilde, i, 201.

† Quoted from the "Parochial Survey of Ireland," in The Folk-lore Journal, ii, 212, London. 1884.

‡ Bender, "Holidays of the French Canadians," in Magazine of American History, xx, No. 6, p. 467, New York, December, 1888.

§ Piers, Westmeath, 123.

described by Kelly,* who identifies the rowan with the Sanskrit palasa, which, according to the Vedas, sprang from a feather dropt by the fire god Agni, who had assumed for a time the form of a falcon. This, again, brings us back to the old fire worship.

The old May dance is thus described by Lady Wilde: "At the great long dance, held in old times on May-day, all the people held hands and danced round a great May-bush erected on a mound. The circle sometimes extended for a mile, the girls wearing garlands and the young men carrying wands of green boughs, while the elder people sat round on the grass as spectators and applauded the ceremony. The tallest and strongest young men in the county stood in the centre and directed the movements, while the pipers and harpers, wearing green and gold sashes, played the most spirited dance tunes."† This dance, equivalent to the May-pole dance of England, has long been discontinued on May-day, altho a similar "long dance" is stil performd in the north around the fire on Saint John's eve.

At Finglas, near Dublin, there was formerly an annual May fair lasting several days, which was celebrated on a grand scale, and was attended by great crowds from the city. The fair was presided over by a queen, drest in gorgeous apparel and wearing on her head a royal crown, and attended by a company of maids and courtiers arrayd in the same splendid fashion. But the fair finally degenerated into an occasion of reckless dissipation, so that it was discountenanced by the respectable citizens, until, about fifty years ago, when the last queen died and the royal show of Finglas came to an end.‡ This custom of a May queen, which does not appear to hav existed elsewhere in Ireland, may hav been introduced by the Danes, who for several centuries held possession of the country about Dublin.

The May boys ar an important feature of the celebration on this day, especially in the west and south. Companies of young men and boys, sometimes as many as a hundred or more together, drest up with ribbons on the arms and shoulders, and gay sashes about the waist, and sometimes wearing fantastic masks made of cloth or paper, march about the country, headed by pipers and fiddlers, who ar often assisted by some of the company with improvised instruments. On coming to the house of a rich farmer or gentleman they halt and sing May songs and perform a dance to the sound of the music, receiving in return a treat or a small sum of money. The dance is generally enlivened by the antics of a "fool," who has his face smeard over with flour and wears a bladder for a skulcap, while, at the end of a long pole, he carries another, with which he keeps order among the noisy spectators. Another fantastic character, drest in woman's clothes and known as the "ape," acts as assistant to the fool.

Several of the May-day beliefs in relation to the dairy hav already been

* Kelly, Folk-lore, 158–167.
† Lady Wilde, i, 195–6.
‡ Hall, Ireland, ii, 345.

mentiond, but these by no means exhaust the list. This is the day above all others when witches and fairies work their spels, and, if the proper precautions ar not taken *before sunrise* to defeat their evil designs, there wil be no luck in the family and no butter in the churn for the rest of the year. Wo to the hare that is found in the pasture on May-day, for it is wel known to be a witch who has assumed this form in order the more easily to accomplish her wicked purposes. One of the best safeguards is to get the clay which collects in the split of the cow's hoofs when she is driven out on this morning, put it under the churn with a coal of fire and some salt, and then proceed with the churning. After this the butter is safe for the year, provided the churning be done before sunrise. If a twig of rowan or whitehorn, gatherd on the preceding eve, be twisted about the churn, so much the better, and, to make doubly sure, it is just as wel to hav the churn-dash also made of rowan. A piece of iron is sometimes kept red hot in the fire while the churning is going on—another instance of the use of the combined forces of fire and iron against evil influences. Should the witch get the first clay from under the hoof and moisten it with three drops of the same cow's milk, secretly obtaind, and place it under her own churn while churning, she can draw all the butter of that cow to herself. According to Lady Wilde, primroses gatherd before sunrise ar also strewn about the house and tied in bunches to the cow's tail on May-day to ward off the fairy influence.* The same author also mentions a traditional snow-white heifer which sometimes appears amongst the cattle on May-day, and always brings the best of good luck to the farmer.†

In Donegal, and probably in some other parts of the country, no housekeeper wishes to be first to light a fire on May-day. This seems to be explaind by a story told as a fact by a Limerick woman. According to her account, a woman who was suspected of being a witch was observd going out to the spring wel early one May morning. The priest followd her and conceald himself near the wel. He saw her perform some spel with the water, after which she waited until she saw the first smoke rise from a neighboring chimney, when she said: *Im an deatac' sin agamsa* (*Im an dhŏthakh shin ŏ'gamsa*), "Butter of that smoke to myself." Soon the smoke rose from another chimney, and he heard the witch mutter: *Im an deatac' sin cuma leis* (*Im an dhŏthakh shin cumma lesh*), "Butter of that smoke with it likewise." By this time the priest's housekeeper was stirring at home, and soon a third column ascended from his own chimney. "*Im a t-sagairt cuma leis* (*Im a thŏgarch cumma lesh*), "The priest's butter with it, too," said the witch; but this was too much for the good man, who sprang from his concealment and laid his riding-whip across her astonisht shoulders. This broke the spel so far as his own butter was concernd, but she got that of the others.

The crops ar sometimes stolen as wel as the butter. The evil-minded

* Lady Wilde, 1, 197.
† *Ibidem*, 1, 195.

person who knows how to invoke the aid of the spirit of darkness goes secretly early in the season to his neighbor's field and sows a handful of grain in some out-of-the-way spot where it is not likely to attract attention. Then by going before sunrise on May morning and reaping it, he is able to take to himself the greater part of that year's crop. A Clare man told how, when a boy, he was once walking with his father through their field of oats just before May-day, when they came upon the witch's tuft in a corner. His father got a spade and, taking up the bunch of oats by the roots, threw it over the ditch, and thus saved his crop. In connection with the crops, Sir Henry Piers, writing in 1682, says that in Ireland May-day was considerd the first day of summer, and on this day, whatever else they might hav, all, even the rich, prepared a dish of stirabout. This was regarded as an evidence of the wife's good management in making the grain last until the beginning of summer, as it was thought that if they could do so wel, they could then very easily get along with the new provisions until harvest.*

The fairies ar very activ at this season, especially on May eve, when they change their quarters from one district to another, and the sound of their music and dancing may then be heard in every green fort by any mortal who has the courage to venture near. Some of the sweetest of the Irish tunes hav been learnd in this way from the fairy pipes, but of the many who hav stopt to listen to the spirit music, few hav ever returnd to their friends. On May morning, also enchanted cities, long sunk below the sea, ar seen to rise once more above the waters in all their old-time splendor, and O'Donoghue, of Killarney, emerges from his subaqueous palace and rides across the surface of the lake on a snow-white horse, attended by all his retinue of knights and maidens.

While every one else is on the alert, it may wel be supposed that the girls ar not idle, and, in truth, most of them ar anxiously consulting the oracles in regard to their marriage prospects. Before going out the door in the morning, the maiden recites a charm, and the first man or boy met on the road after this wil bear the Christian name of her future husband. The first snail found before sunrise wil be of the color of his hair, while its track upon the ground wil mark out the initial of his name, but if the snail hav a "box" or shel, the predestind partner wil be a widower. The snail is taken home and put upon a plate in the sun, where it crawls about for a while and finally stops facing the direction whence the lover is to come. According to Lady Wilde, a black snail met first in the morning is unlucky and an omen of death, while a white one brings good fortune.†

The young women do not trust entirely to the oracle, however, but take some precautions of their own, chief of which is to bathe the face in May dew before the sun rises and to dry it with the hair. This renders the

* Piers, Westmeath, 121.

† Lady Wilde, i, 198.

features fair and beautiful, and also prevents headake and fevers during the year. An old riddle thus alludes to this custom:

"I washt my face in water that never raind or *run*,
And dried it on a towel that never was woven or spun."

In the north, the girls on May morning recite a charm calld the "comedher" to attract the lover. The name is, probably, a corruption of "come hither," and when a young man appears to be fascinated by a girl, she is said to hav put her comedher on him. There is a wonderful virtue in the dew which forms on May morning, when gatherd before sunrise, and some of the knowing women do a thriving business in this line. The May dew is frequently preservd in bottles and rubd on sores, in the name of the Trinity, to quicken the healing process. Herbs gatherd on May eve possess mysterious powers for good or evil, according as they ar pulld in the name of the Trinity or of the devil, and the virtue of the preparation is increast when compounded with butter made on May morning. It may be of interest to Americans to learn that many of these old May-day charms ar stil known amongst the mountaineers of the Southern Alleganies, who hav long since lost most of the folk-lore inherited from their transatlantic forefathers.

There ar a number of miscellaneous customs and beliefs connected with May-day. In many parts of the country, it is considerd unlucky to do any regular work, but the day is spent in mending the fences. This custom is, perhaps, akin to the former English ceremony of surveying the parish boundaries about this time,* a practice, probably, as old as the Roman Terminalia, or feast of Terminus, the god of fields and boundaries. In Kerry, and probably throughout the south, this is also the day for "settling the dues," or arranging what stock shal be kept by each of the partners in a common pasture. In making this settlement, the unit of measurement is calld a collop, the name applied to a sufficiency of pasturage for one cow,† which is held to equal the amount required for eighteen geese, six sheep, hogs or asses, or two mules, while a horse is equivalent to a collop and a half. Thus, if one man pastures six sheep in a field, his partner has the right to put in as many asses or eighteen geese, while a single horse is held to consume as much pasturage as nine sheep. Goats ar not put into the calculation, being usually sent to range the uncultivated mountain slopes. The pasturage sufficient for a sheep, hog or ass is calld a due, and according to this primitiv agricultural table, three bils (of geese) make a mouth or due, and six dues make a collop.

In Clare, a ribbon is left out on May eve, and according as it is found to hav lengthend or shortend in the morning, so wil the prosperity of the family increase or decrease during the year. In Cork, the sun dances in the water on this morning as wel as on Easter, and it was formerly the

* Just before Holy Thursday, near the end of the Lenten season; see Brand, Antiquities, i. 197.

† Gaelic *colM'ac'*, a cow, calf or heifer.

custom to go early in the morning to Sunday's wel, a noted wel near that city, to observ it. A girl born upon this day wil prove to be of a bad disposition, while a cow born at the same time wil be vicious and inclined to gore. Omens ar also drawn from the way in which the wind blows. According to Lady Wilde, ashes ar sprinkled on the threshold on May eve, and if in the morning there be found the print of a foot turnd inward it betokens a wedding, but if turnd outward, a death.*

Grimm, in his interesting subchapter on fire,† notes the fact that in the Germanic countries the Easter or May-fires ar almost entirely confined to the northern provinces, while the midsummer or Saint John's fires belong to the south. Almost every detail mentiond in this paper in connection with the May-fires in Ireland is described by him as a part of the modern Easter celebration in Germany, Denmark or Sweden, while precisely similar ceremonies wer enacted at the ancient Roman festival of the Palilia, which occurd about the same time of the year, viz., April 21. In the festival of Easter, as celebrated in Germany, with its bonfires and dances upon every hil and its lighted tapers in the churches, he sees only a Christian adaptation of the old pagan Bealtuine, or, possibly, of the midsummer feast, which the missionaries wer obliged to incorporate into the service of the new religion, while the very name is derived from that of the heathen goddess Ostara, whose festival was, probably, celebrated about the first of May. In regard to this connection, Grimm says: "Wurden seit der Bekehrung die Deutschen Maifeuer auf Ostern und Johannis verlegt, um sie christlichem Cultus naeher zu bringen? Oder ist, da auch Sonnenwende tief im Heidenthum wurzelte, bloss Osternzeit Stellvertreterin fuer das alte Maifeuer?" and again: "Ihren Namen (Ostara) und ihre Feuer, die vielleicht in Maianfang fielen, verlegte man, nach Bekehrung der Sachsen, auf das christliche Fest." ‡

Whitsuntide.

Whitsunday, in Gaelic calld *Cingcis* (*Cingceesh*), is a movable festival occurring generally about the end of May or the beginning of June, and deservs notice on account of the mysterious fatality connected with it, as wel as with the following Monday and Tuesday. It is an unlucky season, and should a man born on any one of these three days ever throw a stone it wil inevitably kil or cripple some one. No water must be soild during the same period, and for this reason no clothes ar washt from Saturday until Thursday, nor ar any sheep washt for shearing. Neither must one start on a journey or begin any important work, but, above all, no one must go near the water, either for bathing or boating, or even to cross a stream, for at this season one may be drownd in a cup of water. There ar ancient legends to prove the truth of this belief, and every old woman can tel of instances within her own knowledge where a neglect of these

* Lady Wilde, 1, 199.
† Grimm, Mythologie, 1, 567–597.
‡ *Ibid.*, 581 and 583.

precautions has resulted fatally. Death is not inevitable, however, for only one hour of all this time is fatal, but as no one may know which is the hour, or even on which of the three days it occurs, the only way to avoid the evil consequences is to observ the prohibition until the period has terminated. According to Lady Wilde, the fairies ar also to be feard at this season, so that holy water must be sprinkled about the house to keep them away, and at this time also the water spirits come up out of the sea to hold their revels on the shore, and the water-horse rises from the lough to graze at midnight in the green pastures upon its banks.* A dance was formerly held also on Whitsunday, as already described in speaking of Easter Sunday.

Saint John's Eve, June 23.

Next comes Saint John's eve, June 23, better known, perhaps, as midsummer night, after which the sun begins its backward course and the days grow shorter. This was one of the most solemn festivals of the ancient pagan world, and numerous vestiges of it stil exist throughout the greater part of Europe, after nearly two thousand years of Christianity. In fact, such a hold had the old fire worship upon the minds of the people that in many instances, especially in Germany, the teachers of the new faith found it necessary to incorporate the pagan ceremonies into the accepted rites of the church.† In France, Germany, Austria, Italy and the Slavic countries, the observances connected with this festival ar practically identical with those in Ireland. In Servia and the other south Slavic countries, according to Krauss, the very names of Saint John's day and Saint John's fire "wie elektrische Funken im Herzen und Gemüthe des südslavischen Bauernvolkes tausend tolle, lebenslustige, verliebte und glückliche Gedanken entzünden! Wann um mitternächtlicher Stunde auf steiler Höhe der mächtig aufgeschichtete Holzstoss hellodernd gen dunkelblauen sternebesäeten Himmel harzduftende Feuerflammen züngelt, da tanzen Burschen und Mädchen jauchzend und singend um das Feuer gar schnellfüssigen Reigen. Zauberhaft die Nacht, die Feuergluth, zauberhaft der schnelle Reigen, Alles ist bezaubert, Alles zaubert."‡

As has been stated, the fires of Bealtuine hav paled before the Easter tapers, but the midsummer fires stil blaze from every hil-top in Ireland on the eve of June 23, now calld in Gaelic, *Oid'c'e Tein' Seag'an* (*Eha or Eel Chin Shawn*), or the "Night of John's Fire." The introduction of the new calendar in 1752 seems to hav causd some confusion for a time,§ but this can hav been but temporary. Speaking of the old fire worship, Smiddy says, in this connection: "There was a sort of poetry and of mystery about this system, which certainly exercised a powerful fascination over the human mind. The altar and the carn of the Druid have

* Lady Wilde, I, 204–5.
† See Kelly, Folk-lore, 46–8.
‡ F. S. Krauss, Sitte und Brauch der Südslaven, 176, Wien, 1885.
§ Writer quoted in Brand, Antiquities.

been deserted for ages, and yet, to this day, there are living vestiges and memorials of his anniversary fire in Ireland. At a certain period of the summer, when the shades of evening gather over the face of the land, flames of fire are seen to spring like magic from hill to hill, through the whole expanse of the country. They are also lighted in the hamlets and villages and in many of the towns. A few of these take place at Beiltinne, that is, at the beginning of May; but the great blaze is reserved for the eve of St. John the Baptist, the 23d of June."*

In pre-Christian times the first fire was lighted on the hil of Howth, on the east coast of Ireland, near Dublin, and the moment the flame appeard through the darkness a great shout went up from the watchers on all the surrounding hil-tops, where other fires wer quickly kindled until soon the whole country was in a blaze †

The modern ceremonies hav changed but little in the last two centuries. Sir Henry Piers, writing in 1682, says that on this eve there was a bonfire in every town, and that the people carried about blazing torches of dried rushes, so that "a stranger would go near to imagine the whole country was on fire."‡ Another author quoted in Brand, writing in 1723, says, "they make bonfires and run along the streets and fields with wisps of straw blazing on long poles to purify the air, which they think infectious, by believing all the devils, spirits, ghosts and hobgoblins fly abroad this night to hurt mankind."§ These bundles of straw tied to long poles ar calld "clears," and the custom is stil kept up. ‖

It is here in place to say something in regard to the word *bonfire*. As commonly pronounced and as given in the dictionary the word is bonfire, and is derived by most etymologists from the Teutonic *boen* or blessing. It seems probable, however, that the original form and meaning was *bone-fire*. The word is so pronounced in the English-speaking districts of Ireland—where many archaic English forms ar preservd—and the Gaelic name, *tein'na cnam'* (*chin na cnaw*), means exactly the same thing. This may indeed be a mere translation of the English name, but such does not appear to be the case. Kelly, writing upon the midsummer fires, gives the account of a mediæval author as follows: "The bonfires, he says, were lighted for the purpose of scaring away the dragons that poisoned the waters with the slime that fell from them at that hot season, and therefore bones and all sorts of filth were thrown into the fire, that the smoke might be the fouler and more offensive to the dragons." ¶ In several parts of the west of Ireland, especially in Connemara, the bones are stil saved up to burn in the midsummer fires.

The piles for the Saint John's fires ar built of turf, bog deal and furz,

* Smiddy, Druids, 97-98, 1, 304.
† Lady Wilde, i, 214.
‡ Piers, Westmeath, 123.
§ Brand, Antiquities, i, 305.
‖ See quotation from the Parochial Survey of Ireland, in the Folk-lore Journal, ii, 213, London, 1884.
¶ Kelly, Folk-lore, 57.

with sufficient green stuf to prevent its burning too rapidly. The fire is generally lighted after dark, but in some parts of the north it is kindled in the afternoon. The people gather about the fires with pipers and fiddlers, and the evening is given up to dancing and merry-making. In Meath the young folks wer allowd on this night to milk the sheep in the pastures, and came provided with buckets for the purpose, together with oaten bread to dip in the milk, which was boild over the fires in regular picnic style. The next morning was considerd the proper time to hunt mushrooms. It was also customary to walk three times round the fires, reciting certain prayers to ward off sickness during the coming year. In Down the festivities began in the afternoon, when the people went in procession, carrying an effigy called a "Paddy," and danced round the fire to the music of a fiddler. In the Orange districts it was sometimes necessary, thirty years ago, to put out an armed picket to prevent interruption. On asking an old man where the guards got their guns, he said, "We hadn't many, but we had more than the law allowd." As the fires burn low, the young men leap over the blaze, and later on the girls and women walk across the hot embers. Long after midnight, when the pile has burnd down to the ground, the people disperse to their homes, some one of each family carrying a shovelful of live coals to scatter over the fields in order to insure a good crop, with a lighted sod of turf to put into the hearth-fire, to bring down prosperity upon the household. It is also an omen of a good crop to be able to reach the field with a burning brand before the embers hav time to go out.* In the city of Dublin, where bonfires could not wel be kindled, it was customary in the last century to set up a bush in the middle of the street and adorn it with lighted candles.†

Connected with this celebration ar several local customs which wer probably more general in former days. At Armoy, near Ballycastle, County Antrim, the people join hands about a blessed wel in a game known as "Round Ring," and much resembling "Hunt the Handkerchief." One standing on the outside touches some person in the circle, who then lets go his partner's hands and runs round the ring in pursuit of the first, who endeavors to get into the vacated place before he can be caught. If successful, the other takes his place outside the circle until releasd in a similar manner.

In Kerry, and other parts of the west, as the fires burn down, the people pull out blazing brands from the pile and singe the cows with them, in order to bring increase to the herds. The cattle ar sometimes chasd through the fields, at other times collected into pens for the purpose. In former times they wer driven round or through the fire, as on May-day, a custom which stil existed in the north within the present century.‡

* Charles DeKay, Fairies and Druids of Ireland, in Century Magazine, xxxvii, No. 4, 597, New York, Feb., 1889.

† E. W. (1791), Pop. Sup., 55.

‡ Parochial Survey of Ireland, quoted in the Folk-lore Journal, ii, 140, London, 1884.

Coals from the Saint John's fire ar also sewn into the clothes of women to prevent their being carried off by fairies. According to Grimm, a ceremony similar to this singeing or passing of the cattle through the fires on Saint John's eve exists also in France, Germany, Russia, Bohemia and Servia,* but the writer has not been able to learn of the existence in Ireland of the custom mentiond by the same author in this connection, of throwing flowers into the fire or putting herbs over the doorway of the dwelling house or stable.

A writer quoted in the *Gentleman's Magazine* for 1843, in describing a celebration witnesst on Saint John's eve in the King's county, mentions one curious feature, which is evidently a local substitute for driving the cattle through the fire, and which closely resembles a Christmas custom in Wales, another Keltic country, as described in the same article. After speaking of the brilliant effect of the bonfires blazing on every hil, the author continues:

"But something was to follow that puzzled me not a little; when the fire had burned for some hours and got low, an indispensable part of the ceremony commenced. Every one present of the peasantry passed through it, and several children were thrown across the sparkling embers, while a wooden frame of some eight feet long, with a horse's head fixed to one end and a large white sheet thrown over it, concealing the wood and the man on whose head it was carried, made its appearance. This was greeted with loud shouts of 'The white horse!' and having been safely carried by the skill of its bearer several times through the fire with a bold leap, it pursued the people, who ran screaming and laughing in every direction. I asked what the horse was meant for, and was told it represented all cattle." †

Saint John's eve is also a favorit fairy season, when the "good people" hold their midnight revels in every green fort. That the same belief existed in England is evident from Shakespeare's "Midsummer Night's Dream." On this night especially the fairies ar on the watch to carry off incautious mortals, particularly women and infants who ar not protected by a sprig of *lusmór* (foxglove), or some other safeguard against fairy influence. An old writer of 1723, quoted by Brand, mentions a belief that on this eve every human soul leaves its bodily habitation and takes a journey to that place on land or sea where death shal finally separate them forever.‡ This is also a chosen time for visiting many holy places, especially the numerous wels calld after Saint John.§

The following account of the celebration, as stil carried out in the west, is given by Lady Wilde: "The fires are still lighted on St. John's eve on every hill in Ireland. When the fire has burned down to a red glow,

* Grimm, Mythologie, i, 588–591.

† Pop. Sup., 90.

‡ Brand, Antiquities, i, 305.

§ See the author's "Medical Mythology of Ireland," in Proc. Am. Philos. Soc., xxiv, No. 125, 152, Philadelphia, 1887; also, Hall, Ireland, iii, 117, note.

the young men strip to the waist and leap over or through the flames; this is done backwards and forwards several times, and he who braves the greatest blaze is considered the victor over the powers of evil, and is greeted with tremendous applause. When the fire burns still lower, the young girls leap the flame, and those who leap clean over three times, back and forward, will be certain of a speedy marriage and good luck in after-life, with many children. The married women then walk through the lines of the burning embers; and when the fire is nearly burnt and trampled down, the yearling cattle are driven through the hot ashes, and their back is singed with a lighted hazel twig. These hazel rods are kept safely afterwards, being considered of immense power to drive the cattle to and from the watering places. As the fire diminishes the shouting grows fainter, and the song and the dance commence; while the professional story-tellers narrate tales of fairy-land, or of the good old times long ago, when the kings and princes of Ireland dwelt amongst their own people, and there was food to eat and wine to drink for all comers to the feast at the king's house. When the crowd at length separate, every one carries home a brand from the fire, and great virtue is attached to the lighted *brone* which is safely carried to the house without breaking or falling to the ground. Many contests also arise amongst the young men, for whoever enters his house first with the sacred fire brings the good luck of the year with him." *

Samhan, Hallow E'en, or All Souls' Day, November 1.

We wil pass over several minor dates, chief among which is Lady day, on the fifteenth of August, nearly corresponding with the ancient festival of Lughnas, which has given its name to the month, but has now faded from the popular recollection. Next comes the great festival of Samhan, or November eve, calld in the eastern districts Hol' eve, and better known in this country as Hallow e'en, the eve preceding the first day of November, designated in the calendar as the day of All Saints. This appears to have been a universal festival throughout pagan Europe in honor of the goddess of fruits,† which probably accounts for the prominent part playd by the apple in the modern celebration. So firmly wer the people wedded to this pagan festival that the church was compeld to incorporate it into the Christian calendar, merely changing the name so as to give it a new significance.

The Gaelic name of this festival is *Sam'an* (*Sowan*), November being calld *mi na Sam'ain*, the month of Samhan. In ancient Ireland it was the last of the five great fire festivals. Vallancey states that the festival was dedicated to the god of fruits and seeds, and lasted throughout the month of November.‡ The only trace of fire worship remaining in con-

* Lady Wilde, i, 214-5.
† Hutchinson, "Northumberland," quoted in Brand, Antiquities, i, 378.
‡ Vallancey, Collectanea, iii, Part ii, 443 passim.

nection with the modern celebration in Ireland is in the use of lighted candles, but in Scotland and Wales bonfires wer stil kindled with mystic rites a generation ago, while the same custom prevaild also in England at an earlier day.* Smiddy states that the ancient Irish celebrated the day with sacrifices and feasts, and that "the horse was offered as a victim to the sun, and perhaps the human being, too." On this occasion, also, special honors wer paid to the great idol of Crom Cruach, which was set up at a place calld Magh Sleachta, supposed to hav been in the County Leitrim, and which is described as a stone capt with gold and silver, and surrounded by twelv other rough stones. To this idol, until its destruction by Saint Patrick, wer sacrificed the first born of every species, and on the great day of Samhan the people prostrated themselvs before it until the blood streamd from their lacerated faces, knees and elbows. The figure evidently had an astronomic significance. The festival partook of the character of a thanksgiving for the ripend fruits. †

The feast of Samhan was the occasion of the convening of the Feis, or great national assembly of ancient Ireland, which was held every three years at the palace of Tara and lasted for a week, being convoked by the monarch himself three days before the day of Samhan (November 1) and continuing three days after. According to the annalists, this assembly was instituted by Ollamh Fodhla (pronounced Ollav Fola), the first monarch of Ireland and builder of the palace of Tara, who is said to hav flourishd nine hundred years before Christ. The purpose of the convocation, which was attended by all the druids, bards, rulers and scholars of Ireland, was to enact laws and revise the annals of the country. The first two days wer devoted to friendly intercourse, and on the third the assembly was formally opend by the chief bard with music and the recitation of poetry. The sacred fire of Samhan was then lighted and the favor of the gods invoked, after which the regular business of the convention began. Whoever was convicted of murder, theft or quarreling during this period sufferd death, tho at other times punishd only by a fine.‡

With regard to the modern celebration of November eve,§ it may be stated briefly that almost every practice or belief found in Ireland is common as wel to England, Scotland, Germany and other countries of Europe, while, as on May eve, the chief purpose of the mystic rites is to discover to the girls the names and characters of their destind partners. Unless otherwise noted, it may be assumed that the customs about to be described exist in some form throughout the country. The apple is the great feature of the occasion, and is made to contribute in a number of ways to the general enjoyment. Apples ar provided in abundance in every farmer's house, and a favorit pastime is ducking for them in a tub of water. The apple floats upon the water, and each one who makes the trial must kneel

* Brand, Antiquities, i, 388-390.
† Vallancey, Collectanea, iii, Part ii, 457-8.
‡ Smiddy, Druids, 106-110.
§ Hall, Ireland, ii, 387 note.

down with his hands behind his back, and dipping his head into the tub, endeavor to bring up the apple in his mouth. As the apple is forced under the water at each attempt, unless he can succeed in seizing it between his teeth, it may readily be supposed that this simple play affords a vast deal of amusement to those gatherd about the tub.

Sometimes an apple is suspended on a string, fastend at one end to the wall, while the other end is held by one of the company. The biter, with his hands tied behind him, tries to catch the apple between his teeth, while the other strives to defeat his purpose by jerking the string just at the critical moment. To render the feat stil more difficult, the biter is sometimes compeld to bend backward over a stick resting on the backs of two chairs. Again, the apple is hung by a string from the mantel. Then each person runs with head down around a firkin placed in the middle of the floor, keeping his fingers on the firkin all the time until dizzy, and at last, straightening up, tries to take a direct course and hit the apple with his finger.

This last method seems to be a degenerate form of a more elaborate practice which stil exists in the County Clare, as wel as in the north, and may originally hav had an astronomic meaning. A contrivance known as the "snap apple," and somewhat resembling the hub of a wheel with fifty-two spokes, is suspended by a string from the loft, at about the hight of an average man's head. The spokes ar arranged horizontally around the hub in several series one above another, and of every three spokes the first has a short candle blazing at the extremity, the second is sharpend to a point and the third has an apple stuck upon the end. Under it is placed a stool, around which a line is drawn upon the floor. While one person keeps the wheel revolving, each of the others in turn runs around in this circle, stooping down with one hand on the stool, as already described, as many times as there ar spokes on the wheel, when he rises and endeavors to catch the apple, at the risk of being burnd by the candle or scratchd by the sharpend stick should he fail.

A writer of 1784, in the *Gentleman's Magazine*, speaking of this celebration in the eastern counties, says, that in his time an important part of the refreshment provided for the occasion was "lamb's wool," made by bruising roasted apples and mixing the pulp with milk, ale, or even wine amongst the upper classes who wer not too refined to take part in these periodical merry-makings. Apples and nuts always accompanied the lamb's wool.* As far back as 1728, the Dublin servants wer accustomd to demand apples, ale and nuts of their employers on this eve.† Another favorit dish on this occasion is culcannon, whence the festival is sometimes known as "culcannon night." It consists chiefly of potatoes and turnips boild and mashd together, with a generous lump of butter swimming on the top.

Vallancey, also writing in the last century, states that in the south of

* Quoted in Brand, Antiquities, i, 396.
† Brand, Antiquities, i, 377.

Ireland, on this eve, the peasants "assemble with sticks and clubs (the emblems of laceration), going from house to house, collecting money, bread-cake, butter, cheese, eggs, etc., etc., for the feast, repeating verses in honor of the solemnity, demanding preparations for the festival in the name of St. Columb-kill, desiring them to lay aside the *fatted calf* and to bring forth the *black sheep*. The good women are employed in making the griddle cake and candles; these *last* are sent from house to house in the vicinity and are lighted upon the (Saman) next day, before *which* they pray, or are supposed to pray, for the *departed souls* of the donor. Every house abounds in the best viands they can afford; apples and nuts are devoured in abundance."* In a previous passage, he explains the allusion to the black sheep by stating that such an animal was formerly sacrificed by the druids on this occasion for the benefit of the souls of the departed. He also mentions several love charms which wil now be described.

Quite a number of experiments ar tried by the girls with beans or nuts to test the affection of their sweethearts. Sometimes two nuts ar named after a pair of lovers and placed in front of the fire. If either cracks or jumps away from its place, the one whose name it bears wil prove inconstant. Should it blaze up brightly, its namesake has an affection for the one represented by the other nut, and if the two burn quietly together the lovers wil be married. In Kerry, the trial is sometimes made with beans, large ones being used to represent the young men, while smaller ones serv for the young women. If neither one of the pair jumps away from the other, they ar lighted and allowd to burn to a coal, after which they ar put into a glas of water. Should both sink, it is a sign that the lovers wil be married; if neither, they wil never be wedded; but if only one sinks, it is, as the people say, "between I wil and I won't." Again, white beans to represent the girls, and black beans for their lovers, ar placed in pairs on a pan over the fire. If the black bean remains by the side of the white one, the girl knows her lover is true to her, but if it pops over to the neighborhood of another white bean, she knows that the recreant sweetheart has been won from her by the rival whose name the white bean bears.

The lover sometimes roasts ten beans, and then, throwing one of them over the shoulder and taking the other nine in the mouth with a sup of "mairn" water, he goes to three houses in succession and listens secretly on the outside.† The first name belonging to one of the opposit sex heard spoken inside the house wil be that of the future husband or wife, as the case may be. If the same name be heard at the next and the third house the omen receivs additional confirmation, but should a different name be heard in the second house, that wil be the name of the destind

* Vallancey, Collectanea, iii, Part ii, 459.

† The selection of ten objects, one of which is afterwards thrown away, is of common occurrence in Irish folk-lore, and wil be met with again in this chapter. For another instance, see the author's paper on "The Medical Mythology of Ireland," in Proc. Am. Philos. Soc., xxiv, No. 125, p. 144, Philadelphia, 1887. A "mairn"—properly mering—stream is a boundary ditch between two fields.

partner in case the other should die, and so on with the third. One old man admitted that he had tried this in his young days, at a time when he was paying some attention to a girl named Mary, whom, however, he had no intention of marrying. Sure enough, what name did he hear at the first house but Mary. He went on to the next, and again he heard the same name. Afraid to go to the third, he spit out the beans and the water, exclaiming in a passion, "To hel with Mary!" He finally fulfild the prophecy by marrying a Mary, but a different one, of whom, at the time, he had no thought. His wife, who had been an interested listener, added, "No, but she was kind to you."

Two pieces of alum ar sometimes christend in the same way and placed together near the fire. If they melt or run together, it is a sure token that the fortunes of the lovers wil be joind, but otherwise, they wil never wed each other.

The young folks also go blindfolded into the garden at midnight to pull up cabbages, and according as these ar full or stunted, with straight stalks or crooked, so wil the future partner be of fine appearance or witherd and misshapen, or neat or slovenly in habit. The stalk is taken home and placed over the door, and the first one who comes under it in the morning wil bear the Christian name of the destind husband or wife. The cabbage stalks ar sometimes thrown against the doors of the farmers.

Another mode of divination is by means of melted lead, which is pourd through the ring of a key into a vessel of water drawn from a spring wel. The shape assumed by the metal on coming in contact with the water indicates the trade or occupation of the coming man. Each girl making the trial must hav a separate vessel of water, and the water must be brought and the operation performd in silence.

Three basins ar also ranged on a table, the first containing clean water, the second, calld the *baintreabʻac* (*bonchŏrakh*) or "widow" containing dirty water, and the third fild with clay. With eyes closed or blindfolded, each girl then walks up to the table and lays her hand on one of the basins, and according as she touches the clean water, dirty water or clay, so will she find a handsome mate, an ugly husband or widower, or a grave before the end of the year. In the south, according to one authority, the basins ar fild respectivly with water, earth and meal, symbolic of long life, death within a year, or the attainment of wealth.*

In Limerick a cake is baked with a ring inside, from which omens ar drawn in the manner already described in treating of Shrove Tuesday.

Various devices ar resorted to in order to dream of the future husband, the method generally adopted being to eat something which wil cause intense thirst, in the belief that the apparition of the destind man wil come to the bedside of the sleeping girl at midnight and offer her a drink from a glass of water which has been placed conveniently near. Sometimes a cake containing a large quantity of salt is baked, and must be eaten in three

* O'Hanlon (1865), in English Traditions and Foreign Customs, Gentleman's Magazine Library, 29, Boston, n.d. (1885).

bites. Again it is a salt herring, which must be stolen and eaten, bones and all. Sometimes the girl takes ten pins, and, throwing one over her left shoulder, sticks the remaining nine into an apple, which she places under her pillow on retiring. But the most elaborate method of augury is that performd with the eg. For this purpose the first eg ever laid by a black hen must be procured and boild until hard, when the yolk is taken out and the cavity fild with salt. On retiring at night the girl eats the eg and then gets into bed backward. A glass of water has been placed on the table at the bedside, but she must endure the burning thirst until the hour of midnight, when her destind partner wil infallibly appear and offer her a drink. In no case must a word be spoken or a drop of water taken after eating the eg.

Hemp seed is also sown by the maiden, who probably repeats a secret formula at the same time, and it is understood that, on looking back over her left shoulder, she wil see the apparition of her future spouse gathering the hemp. Akin to this is the practice of winnowing grain at the barn door, with the same result of seeing the figure of the destind husband before the task is ended.

Most of these methods of love divination, altho common enough, ar considerd somewhat uncanny, but those now to be described ar regarded with undisguised horror, as being veritable compacts with the powers of darkness, and few can be found who wil admit ever having tried them, while the majority profess ignorance of the whole subject.

Chief among these unholy rites is that known in Gaelic as *Tarruing na Sruit* (*Thŏrinj na srŭh*), or, "the dragging of the stream." The one who thus seeks the aid of the demons takes her smock, or, if a man, his shirt—the garment must always be that worn next the skin—and, going under cover of the darkness to a "mairn" stream, washes it in the water, drawing it always against the current, "*ann ainm an d'eam'ain 'sa d'iab'ail*,"* *i.e.*, in the name of the fiend and the devil. The smock is drawn against the stream because the whole performance is believd to be in direct opposition to the laws of God. Returning to the house the girl sweeps the hearth clean, and then hangs the garment on a chair before the fire, expecting, just as the clock strikes twelv, to see the ghostly shape of her future husband enter the room and turn the smock. In some cases a razor and looking-glass ar added in order that the lover may shave himself.

Stil more terrible is the conjuration of the ball of yarn and the lime kiln. As described by one informant, the girl who dares risk the event of this awful spel goes at night to the nearest lime kiln—in which an oracular spirit is supposed always to reside—and in the name of the devil throws into it a ball of yarn, retaining one end of the thread in her hand. She begins to wind up the yarn, but soon feels a pull at the other end and asks, "Who pulls my yarn?" when the spirit within the kiln calls out the name of her future husband, whose figure she then sees rising out of the

* Pronounced, *An dnim an yowan sa youl.*

pit before her, on which she must turn and run with all speed toward the house, repeating a terrible charm as she goes. The shape pursues her, but as it comes nearer it loses the appearance of her lover and becomes a horrible demon, uttering the most blood-chilling cries. Should it overtake her, the unfortunate girl would be torn in pieces, but if she can enter the house and lock the door before the monster comes up she is safe, altho in almost every case she falls on the floor in a dead faint from terror. Sometimes the baffled demon peers in through the window, but, strangely enough, no one but the girl herself can see the apparition or hear the horrible sounds. At the moment of the occurrence the future husband, whose spirit is thus made to appear, is conscious of some mysterious disturbance in himself, without being aware of the cause. The working of this diabolic spel always results unfortunately, and the children born to the girl after marriage ar almost certain to be idiotic or deformd.

A writer in the *Gentleman's Magazine* givs a somewhat different account of this ceremony. According to his statement, if the girl winds on and feels nothing pull at the other end, it is a sign that she wil die unmarried; if something pulls, she asks the question, when her future husband wil giv his name or appear to her, but sometimes a demon wil approach instead, and this is a token that her death is not far off.* Vallancey says that the Lord's Prayer is recited backwards while winding up the yarn on the ball.†

Lady Wilde hints mysteriously at another awful incantation performd in front of a looking glass in the devil's name—something so unspeakably fearful in its nature that one young girl who tried it was found the next night with distorted features lying dead before the mirror, while the glass itself was shatterd to pieces. The same author continues:

"Another spell is the building of the house. Twelve couples are taken, each being made of two holly twigs tied together with a hempen thread; these are all named and stuck round in a circle in the clay. A live coal is then placed in the centre, and whichever couple catches fire first will assuredly be married. Then the future husband is invoked in the name of the Evil One to appear and quench the flame. On one occasion a dead man in his shroud answered the call and silently drew away the girl from the rest of the party. The fright turned her brain and she never recovered her reason afterward."‡

This season is also a great time for fairies, ghosts and witches. In Connemara, the churn-dash is trimd with *crann caoran*, or rowan twigs, on November eve, to prevent the stealing of the cream by the witches during the coming year. The author just quoted also states that if the cattle fall sick about this time the blame is laid upon the witches.§

* O'Hanlon (1865), in English Traditions and Foreign Customs, Gentleman's Magazine Library, 29, Boston, n.d. (1885).

† Vallancey, Collectanea, iii, Part ii, 460.

‡ Lady Wilde, i, 209–210.

§ *Ibid.*, 211.

On this night it is dangerous to be abroad, and no one would think of telling a fairy story, because the fairies ar then going in troops from one green fort to another, making merry with their elfin comrades and dancing to the sound until the first gray streak of day appears in the east. In Connemara, they carry about with them a golden halter, with which they ar able to seiz and drag off incautious mortals to their underground abodes, but he who is so fortunate as to get possession of this rope wil thenceforward know the hiding-place of all the fairy treasures. Should any one meet a company of fairies on their travels and hav the presence of mind to throw at them a handful of dust from under his feet, they wil be compeld to release any mortal prisoner they may hav with them.

On this night it behoves one to be on his guard against the puca, a hateful goblin monster, assuming by turn the form of a horse, a bull, a goat, or a dwarfish imp, with all the intelligence of a man and all the malice of a demon. From this Keltic name—alike in Gaelic and Welsh—is derived the English Puck. A favorit trick of the puca is to present himself in the guise of a gentle horse to some belated foot traveler, who is easily induced to mount in order the sooner to reach his journey's end. The puca sometimes facilitates the operation by approaching stealthily from behind and deftly inserting his head between the legs of the victim. Then begins a wild ride over hil and dale, through fields and across meadows, until at last the puca halts on the edge of a lofty clif and with a sudden toss hurls his victim down upon the rocks below. On this night, also, it is said that he spoils the sloes and the blackberries, so that they ar no longer fit to be eaten. The same belief, transferd to the eve of Michaelmas, September 29, is found also in Cornwall.*

While the fairies, the witches and the puca are thus abroad, the dead also leav their graves to revisit once more their former haunts and mingle unseen with the living. In order that they may be comfortable and know they ar not forgotten on this one night in the year, their pitying friends sweep clean around the hearth and build up a good fire so that the ghosts may warm themselvs after leaving their chilly graves, while food and milk in abundance ar set out for their refreshment. At the same time the souls of the departed ar especially rememberd in the prayers of the living. Those, also, who ar not dead, but in captivity with the fairies, ar now permitted to return again to their old homes for a few short hours, and it is even said that the spirits of the dead join in the fairy revels on this one night of the year. Lady Wilde also states that "on November eve, by certain incantations, the dead can be made to appear and answer questions; but for this purpose blood must be sprinkled on the dead body when it rises; for it is said the spirits love blood. The color excites them and gives them for the time the power and the semblance of life."†

From one of Wakeman's charming Irish letters in the Washington *Evening Star*, we extract the following account of a recent November eve

* W. S. Lach-Szyrma, in Folk-lore Journal, i, 365, London, 1883.
† Lady Wilde, i, 207.

celebration in far-off Donegal. Altho somewhat lengthy, it comes all in good place and mentions several features not previously referd to:

"Of all brief periods of Irish pleasure, Hallowe'en yields the sweetest, because the most harmless and innocent, delights. It is the night of unbounded mirth, witching charm and sinless dream. It is then that the tenderest of all superstition's eerie broods, the kindly Irish fairies, mingle with human moods and wish, and weave their friendly spells through all the warp and woof of thought, emotion, dream and desire. And his is an insensate heart that will not grow younger and tenderer under the influence of those mirthful revels. Where will one begin and end in telling them as he sees and feels them? Over every door to house, room or barn, an apple-paring was hanging, and some maiden's eager eye was watching for him who first passed beneath, for that one the fairies had charmed as her beloved. Groups of lads on all-fours ducked their heads in buckets of water and brought out small coin with their teeth. Lasses were busy cutting out alphabets with which the fairies were to spell, in water basins, secretly-cherished names. Stolen herrings—which must be salt, must be broiled without turning, eaten with hot tongs, and dreamed on, 'without drink'—now made their appearance. Then the 'bannock-baking' and its wild merriment. Whoever turned the bannock on the huge griddle that hung from the crane was to wed her whose nimble fingers kneaded its oaten meal, salt, soda and water together. 'Nut-burning' and 'snap-apple' were going on merrily at the hob. The hazelnut ashes in dainty packets beneath the pillows yield charmed dreams; the burning 'snap-apples' tell whether loving pairs will sputter or mellowly age during wedded life. Then there was the 'dumb-cake' making for fairy-aided dreams; the 'charm-pies' with their buttons for old bachelors, thimbles for old maids, and rings for the lucky ones who should wed; the 'candle-and-sweets,' suspended and whirling between grinning faces where teeth snapped for bites, and luckless frowsy hair was singed; and an hundred other innocent delights, leading to the more serious affairs of 'postman's-knock' and 'forfeits,' where genuine old-fashioned kissing was there for the fighting; and the struggle for your 'rights' with a bouncing Irish lass from the mountains insured her hatred if you did *not* overcome her, and a sore body and broken bones if you did!—and then, amid deafening clatter and chatter, the supper in the great-room, piled upon tables like fat stalls in a plethoric market, various, smoking, awful; but with the jolliest, hungriest crew you ever broke bread with in your life. And oh, for room in which to tell the tales here told, to give the songs here sung, to reproduce with all the delicious floriture the quips and jokes here perpetrated; while oceans of tea flowed gurglingly, and the poteen, clear as rock-water and as guileless of excise, went on its 'winding' way. * * *

"A hullabuloo without now arrested our attention. 'The byes' had planned a great surprise. Sallying forth when the tales and songs were at their height, they had descended upon another Hallowe'en party a few miles distant, and by main force had captured and brought a fiddler bodily

away, the whole crowd of defeated friendly rivals following after in prideful acclamation. And here they came with wild whoop and hurroo, carrying their prize on their shoulders into the great room, where the procession was received with ringing cheers. It was old Billy Drain, the blind fiddler, all the way from Belfast; hero now above all pedagogues and strangers; hatless, coatless, breathless from the odd melee, but with pursed and smiling mouth and positive radiance shining from his white locks and beaming from his blinking upraised and sightless old eyes. Was there a dance this Hallowe'en night at that farmhouse on the ancient Kilmacrenan road? Ask the rafters of oak that shivered a century's splinters and mould upon the vaulting heads and heels of this big-hearted Irish peasantry. And ask the stars that looked softly down until their shining eyes went out in the brighter dawn which lifted flaming cones upon the peaks of fair Glendowan." *

Saint Martin's Day, November 11.

We come now to Saint Martin's day, a festival which for some reason seems to be connected with animal sacrifice throughout Christian Europe. Among the ancient Greeks this day was the beginning of the Vinalia or feast of Bacchus, which lasted four days and was a season of public carousing, being considerd the time for trying the new wine, but there is no mention of sacrifices. In modern Europe also it is—or was—a time for testing the new wine and for feasting, drinking and public sports, but, in addition to this, we find among all the northern nations traces of sacrifice, which may hav come down from the old Teutonic and Keltic religions. With the more practical moderns, this rite has generally degenerated into a simple provision of the winter's meat. On the continent, the animal commonly selected to die on this occasion is a goose, a preference for which the Norse assign a legendary reason. In England, the goose is kild on Saint Michael's day, September 29, while Saint Martin's day is considerd about the proper time to kil beef and hogs for winter, whence it comes that a beef is calld a marten in the north of England. In Gaelic Ireland, a beef cow is calld a *márt* (*marth*). In England, it is said that on this night water is changed to wine, a belief transferd in Ireland to Twelfth-night, while in both countries it is held that on this day "No beam doth swinge, nor wheel go round."

Saint Martin, who has been styled the second apostle of France, came of a noble family in Pannonia, now included under the government of Hungary. By his father, he was designd for the military profession, but this life was distasteful to him, and he became a religieux, being finally appointed bishop of Tours. He died, surrounded by his clerical companions, about the year 397. In the history of his life, even as related in Butler's "Lives of the Saints," a work which deals largely in the marvelous, we find nothing to account for the strange legends and practices

* Edgar L. Wakeman, Afoot in Ireland, in Washington (D. C.) *Evening Star*, Nov. 17, 1888.

connected with his name, and the conclusion seems irresistible that these belong properly to some earlier pagan god or hero.* Can it be that under the name of Saint Martin, the modern peasant is honoring Mars, the ancient god of war? The bloody rites which so distinguish this day from all others might wel bear out such an assumption.

In Ireland, the poorer people sacrifice a goose or a rooster, while the wealthier farmers and graziers offer a sheep. When a rooster is to be the victim an effort is made to procure a black one, and in some districts it must be a *coilleach Mártain* (*cŏlyakh Marthan*), or March cock, *i. e.*, one hatcht in March from an eg laid in the same month. Strangely enough, a rooster is never sacrificed in some parts of Kerry, where the people dislike to kil one under any circumstances. The doomd animal is previously "named for Saint Martin," that is, dedicated for a sacrifice in his honor on Saint Martin's day, and the vow is seald by "drawing blood" from it. In the case of a sheep, this is done by cutting a piece from its ear. A weakly sheep is sometimes thus consecrated, and so wel tended in consequence that it may become the best in the flock, but no money would tempt the owner to sel it for any other purpose, altho there is no objection to selling the wool. The animal is kild on the day preceding the festival, and the flesh is eaten on Saint Martin's and succeeding days until consumed, a portion being also given to the poor in honor of the saint. The chief object in killing the animal is not to feast upon its flesh, but to "draw blood" for the saint, and it is believd that if any fail to draw blood for Saint Martin, he wil draw blood from them.

In illustration of this belief, there is a story told in Connemara to the effect that a man once named a sheep for Saint Martin, but as the day approacht the animal was in such fine condition that his avaricious wife was constantly urging him to sel it insted. Afraid to break his vow, and equally unwilling to incur his wife's displeasure, he secretly kild a fowl and smeard the bed with the blood. Then getting into bed and covering himself up as if sick, he persuaded the woman that the saint was drawing blood from him in punishment of the contemplated impiety, until such fear seizd her heart that she was as anxious as himself to see the sheep kild.

In Kerry, they tel a story of a man who had been always mindful to draw blood for Saint Martin, but who, for some reason, was at last banisht from his nativ land. One night, in his new home, he was going along a road all alone when he suddenly rememberd that it was Saint Martin's eve, and there came over him a feeling of deep regret that he could not be at home to draw blood on the occasion. At that moment a horseman rode up from behind and inquired where he was going. On being told, the stranger said that he was going the same way and invited the man to ride behind him on the horse. He consented, and mounted behind the

* It is, indeed, related that he once restored a woman's child to life, but the story as told seems hardly sufficient to giv rise to the legends in connection with the drawing of blood on this day.

other. Soon the night grew so dark that he could not distinguish objects about him, until, at last, the stranger set him down at the end of his journey, and, sure, where did he find himself but at his own door at home in Ireland. "It was supposed from this," added the old man who told the story, "that the horseman was Saint Martin."

Like the other festivals, Saint Martin's day is considerd to begin at midnight and to last until the following midnight. The blood must be drawn before the "day" begins—usually on the eve—as it is a common saying that the saint wil take it before, but not after. A part of the blood is soakt up with tow or cotton and preservd for use in connection with certain prayers in the cure of various ailments.* In parts of Galway the blood is not preservd, but is sprinkled about the house and upon the people, and a bloody cross is markt upon the forehead of each member of the family. Those who ar too poor even to afford a rooster sometimes gash one of their own fingers for this purpose.

The following detaild account of the practice as it exists to-day on the west coast, together with the reason assignd for the usage, is given by Lady Wilde, and applies equally wel to other districts where the primitiv customs ar stil kept alive:

"There is an old superstition still observed by the people, that blood must be spilt on St. Martin's day; so a goose is killed, or a black cock, and the blood is sprinkled over the floor and on the threshold. And some of the flesh is given to the first beggar that comes by, in the name and in honor of St. Martin.

"In the Arran isles, St. Martin's day is observed with particular solemnity, and it was held necessary, from ancient times, to spill blood on the ground in honor of the saint. For this purpose a cock was sacrificed; but if such could not be procured, people have been known to cut their finger in order to draw blood, and let it fall upon the earth. The custom arose in this way: St. Martin, having given away all his goods to the poor, was often in want of food, and one day he entered a widow's house and begged for something to eat. The widow was poor, and having no food in the house, she sacrificed her young child, boiled it, and set it before the saint for supper. Having eaten and taken his departure, the woman went over to the cradle to weep for her lost child; when, lo! there he was, lying whole and well, in a beautiful sleep, as if no evil had ever happened to him; and to commemorate this miracle and from gratitude to the saint, a sacrifice of some living thing is made yearly in his honor. The blood is poured or sprinkled on the ground, and along the door-posts, and both within and without the threshold, and at the four corners of each room in the house.

"For this symbol of purification by blood the rich farmers sacrifice a sheep; while the poorer people kill a black cock or a white hen, and

* See the author's "Medical Mythology of Ireland," in Proc. Am. Philos. Soc., xxiv, No. 125, p. 164, Philadelphia, 1887.

sprinkle the blood according to ancient usage. Afterwards the whole family dine upon the sacrificed victim. In some places it was the custom for the master of the house to draw a cross on the arm of each member of the family, and mark it out in blood."*

Another legend makes it his own son whom Saint Martin, like Abraham of old, was about to sacrifice out of love to God, because in his great poverty he had nothing else to offer him. Altho he loved the boy more than life, he kild him late one night, and then lay down, intending to complete the sacrifice at daybreak. On opening his eyes in the morning, he was surprised to see a sheep hanging up in front of him, all skind and drest. Full of wonder he went over to his son's bed, and there he found the boy sleeping quietly and in perfect health, with not even a mark to show where his father had driven the knife. The saint gratefully offerd up the sheep as a sacrifice to God in the place of his son, and thus the custom originated in remembrance of the miracle.

Saint Martin is stated to hav been a miller, and his festival is said to commemorate the day on which he was "drawn on the wheel," an expression which seems to hint at martyrdom and the rack, altho there is no authority for believing that he was either a miller or a martyr. In accordance with this tradition, it is held that no wheel should turn, or anything go round, on this day; no yarn may be spun, no mil may grind and no cart may be driven on the highway. Even a stocking should not be knitted, because in so doing it is necessary to turn it round upon the hand, and the boatman wil not put out from shore on this day, because in starting it is customary to turn the boat round on the water. So strong is this feeling that even in the city of Limerick the large factories sometimes find it difficult to procure a working force on the eleventh of November.

Saint Stephen's Day, December 26.

Christmas and New Year may properly be treated together, but Saint Stephen's day, the day after Christmas, deservs a separate notice, as it is one of the greatest of the Irish holidays, being always an occasion of mirth and merriment, in spite of bad crops and political agitation. The peculiar custom of carrying the wren (universally pronounced *wran*) on this or the preceding day seems to hav been common to the whole Keltic race, being found in Ireland, Man, Wales and France, altho, strangely enough, it is unknown in the extreme north of Ireland. In ancient Rhodes, the swallow was carried about by bands of children in early spring time, with singing of verses and demands for small gifts, very much in accordance with the modern Irish practice. Various stories ar current in Ireland to account for the cruelty shown the wren on this occasion, the reason commonly assignd being that the wren once gave the alarm to an army of invaders—according to one account, the followers of William of Orange, but by others said to hav been the Danes—by perching upon a drum head

* Lady Wilde, ii, 131–2.

and thus waking a sleeping sentinel just as the Irish wer on the point of surrounding them. This very much resembles the old story of the sacred geese of Rome, but aside from the fact that the same tradition is related of other armies in other countries, being merely one factor in the universal folk-lore of Europe, the existence of the custom in France and Wales shows that it had its origin in some ancient Keltic festival prior to the introduction of Christianity. In the Isle of Man, the people defend the practice by saying that at this season the wren's body is animated by the spirit of a wicked fairy resembling the German Lorelei, and who can be kild at no other time.* Vallancey asserts that the custom originated in Ireland through the contrivance of the early Christian missionaries, who found the wren an object of superstitious regard amongst the people, and accordingly undertook to overcome this feeling by ordering that he should be hunted and kild on Christmas day, and his dead body carried about in triumph on the day following.† In Ireland and Germany, the wren is considerd the king of birds, having won the kingship in a contest with the eagle, a story as old as the days of Aristotle and Pliny, as we ar reminded by the Latin name of *regulus* or "little king." In Breton legend, it is said to hav brought down fire from heaven, which would account for its sacred character among the Kelts.‡

For some days before Saint Stephen's, and especially on Christmas, troops of boys go about the hedges searching for wrens. The instant that one is perceivd, he is pursued by the whole crowd with stones and clubs, and it is generally but a few moments before his lifeless body is in the hands of his captors. It is believd in some parts that the wren is blind on this day, and therefore the more easily caught. Early in the morning of Saint Stephen's day, the various companies gather at their respectiv head-quarters with bushes of holly or furz, which ar elevated on poles and decorated with the bodies of the slaughterd wrens, the more the better. A live bird is frequently tied by the legs to the top of the bush and is allowd to hang thus, with head down and wings vainly flapping, as the procession moves along. There is sometimes but one wren, which, in the south, is frequently carried in a frame consisting of two hoops, crossing each other at right angles, and fixt to the end of a long pole. Occasionally, dead wrens ar worn in the caps of the members of the party, some of whom wear masks as on Saint Bridget's eve. In Limerick and the adjacent districts of Clare, and sometimes also in Longford, and, perhaps, elsewhere, the wren is carried in a small coffin resting on a bier borne by four pall-bearers. In the Isle of Man also the wren is carried on a bier, and the whole ceremony is a whimsical travesty on a funeral.§ In Ireland, however, the proceedings ar by no means of a somber character. The crowd of boys and young men is generally accompanied by a piper

* Kelly, Folk-lore, 77.
† Vallancey, Collectanea, iv, Part i, 97.
‡ Kelly, Folk-lore, 75.
§ Waldron, quoted in Brand, Antiquities, i, 472.

or fiddler, or at least by an expert trickster and tumbler, and in high good humor, and, carrying aloft the captured wrens, they go from house to house singing appropriate verses, and expecting in return a small gift of money, food or drink, on penalty of burying the wren in front of the door in case of refusal. This burial of the wren would doubtless be considerd to bring bad luck to the members of the household, but, at all events, it would inevitably brand them as ungenerous, and this alone has such an effect upon the miserly ones that in all the author's inquiries he has heard of but one case in which the wren was actually buried in this manner. The money collected during the day is spent in a convenient tavern at night and a considerable portion is usually distributed among the poorer people. It should be stated that the "wren boys," as they ar calld, generally confine their visits to the houses of the wealthier farmers and gentry. When two parties of wren boys from different parishes come into collision there is frequently a contest for the possession of the wrens. In the city of Cork, where it is naturally somewhat difficult to procure birds, a dead mouse is sometimes made to do duty insted.

In Hall's "Ireland" it is incorrectly stated that the hunting of the wren is confined to the southern districts of Ireland,* but this is a mistake, for the custom is practiced in each of the four provinces. In Ulster, the northern province, it certainly exists in the counties of Cavan, Fermanagh and Tyrone, but seems to be unknown in Donegal, Antrim and the extreme north.

The songs sung by the wren boys vary greatly in character and meter, and many of them ar doubtless improvised for the occasion. Like those sung on Saint Bridget's eve, a number ar clearly of English origin. Some of them ar mere nonsense rimes, but the first verse sung at each house is the same all over the country, the Gaelic form used in the west being nearly the equivalent of the English verse used in the eastern districts, and, as this verse refers more especially to the custom of the day, it is doubtless the original, to which the others hav been tackt on later. The Gaelic version stil used in Galway is as follows :

Dreolin, dreolin, rig' na n-eun,
Lá Steafáin a gab' an t-eun.
Is beag é f'éin, is mór a m'uintir,
Agus dá g'ab' sé capaire déanfaid' sé rince. †

Which may be renderd literally :

Wren, wren, king of the birds,
On Stephen's day the bird was caught.
He is small himself, his family is great,
And if he gets an oaten cake, he wil make a dance.

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* Hall, Ireland, I, 13.

† Pronounced : *Jroelyeen, jroelyeen, re na n'yaen,*
Law Schúfawn a gow an chaen.
Iss byug ae haen, iss moer a winchir,
Ŏgus dhaw ghaw'shae cāpara yena shae rinca.

The following is the corresponding verse used in the English-speaking districts:

The wran, the wran, the king of all birds,
Saint Stephens'es day he was caught in the furz.
Altho he's but small, his family's great;
Rise up, landlady, and giv him a *thrate*.

Among the verses added in different parts of the country ar the following, the names being changed according to the house visited:

1. Mister O'Brien is a worthy man,
And to his house we brought the wran—
We brought the wran to visit you here,
Wishing you a happy Christmas and many New Years (*sic*).—CORK.

2. The wran was so cute and I was so cunning,
He stood in the bush while I was a-running.
On Christmas day in turning a spit,
I burnt my finger and I feel it yet.
Between my finger and my thumb
There lies a blister as big as a plum.—CORK.

3. My shoes ar wore, my coat I tore,
I followd the wran three days or more.—MEATH.

4. The wran is dry and so am I,
Giv us something or we'l let him fly.
From bush to bush, from tree to tree,
They hunted the wran along with me;
Then up with the kettle and down with the pan,
And giv us a drink and let us be *gan*.—LIMERICK.

5. Come huntin' the wren, says Robin to Bobbin;
Come huntin' the wren, says Richard to Robin;
Come huntin' the wren, says Jack Tilaone;
Come huntin' the wren, says every one!*

6. We hunted the wren through frost and snow;
We hunted the wren seven miles or more;
We knocked him down and he could not see;
And we brought him home in a holly tree.*

7. *T'ugas t'u mo d'reolín liom air saot'ar,*
Agus air a g-Cnoc Árd-d'roig'eanac' b'í se air bèile.
'Nuair-a b'í se d'a t'áirt agus a t-anam da creat'ad'
D'iarr se a t'ab'airt go dtí Mister Read'mond.
Air M'ister Read'mond è f'ein a f'uascailt,
Beoir 'gus coiſi go fairsing da c'om'luc'd.†—KERRY.

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* Probably used in Galway or some other part of the west. From Edgar L. Wakeman, Afoot in Ireland, in Washington (D. C.) *Evening Star*, Dec. 22, 1888.

† Pronounced: *Huggas hu ma ghroolyeen loom er saehar,*
Ŏgus er a gnuc ardh-reenakh ve shae er baela.
Nur-a ve shae ghaw hoorch ŏgus a thunnam dhaw khraeha,
Jeer shae a hoorch go jee Misther Raymond.
Er Visther Raymond ae haen a wuasculch,
B'yoer 'gus coffee go furshing dhaw khoalakhdh.

This, which is not strictly grammatic, may be renderd :

I hav brought to you my panting wren ;
And on the high blackthorn hil* he was at his meal.
When he was exhausted and his soul a-trembling,
He begd to be taken to Mr. Raymond.
From Mr. Raymond, to release himself,
Beer and coffee in abundance (to demand) for his companions.

8. As down the glen, boys, we did *bate*,
Our gentleman to overtake,
We overtook him in the glen,
Which caused our wran boys for to sing—
Sing holly, sing ivy—sing ivy, sing holly,
Christmas day it is all but a folly,
But Christmas comes but once a year,
And when it comes, it brings good cheer.—CORK.

9. The wran, the wran, the king of all birds,
Saint Stephens'es day, he was caught in the furz.
I broke all my toes a-gathering the sand,
Pray, madam, do giv me a drop of the dram.—CAVAN.

10. Here comes I, says Beelzebub,
And over my shoulder I carry a club,
And in my hand a dripping pan,
I call myself a jolly old man.—CAVAN.

11. Sing holly, sing ivy—sing ivy, sing holly,
A drop just to drink, it would drown melancholy,
And if you fil it of the best,
I hope in heaven your soul may rest ;
But if you draw it of the small,
It won't agree with my boys at all.—KERRY.

Nos. 4 and 11, like the verses already given under Saint Bridget's eve, ar evidently derived in part from some old English verses sung on Saint Catherine's day, November 25, by children going from house to house like the Irish wren boys. Among those quoted by Brand ar the following :

Up with your kettle and down with your pan,
Give us an answer and let us be gone.
* * * * * * *
Roll, roll,
Gentle butler, fill the bowl ;
If you fill it of the best,
God will send your soul to rest ;
But if you fill it of the small,
The devil take butler, bowl and all.†

No. 10 is probably derived from an old Christmas drama of Cornwall,

* *Cnoc Ard-d'roig-eanac'*, "the high blackthorn hil," overlooks the town of Tralee in Kerry.

† Brand, Antiquities, i, 413-4.

described by a writer in the *Gentleman's Magazine*, in which one of the characters, known as Rub a-bub, enters, saying:

> Here comes I, Old Rub, Bub, Bub, Bub;
> Upon my shoulders I carries a club,
> And in my hand a frying pan,
> So am I not a valiant man? *

The Christmas Holidays, New Year and Twelfth-night.

The Christmas holidays ar supposed to include the whole season from Christmas eve to Twelfth-night, and may properly be treated together, with the exception of Saint Stephen's day, which has already been noticed. The holiday season therefore lasts nearly two weeks, the principal days being Christmas, December 25; New Year, January 1; and Twelfth-night, January 6. In England and in some countries on the continent, the season was formerly considerd to begin at Hallow e'en and extended to Candlemas, February 2, thus embracing a period of three months.

With regard to the origin of these winter holidays, it may be stated that, like nearly every other festival in the modern calendar, they ar simply heathen festivals which the church, being unable to suppress, found it necessary to tolerate and finally to invest with a Christian significance. This festival season was common to all the prominent nations of antiquity, even as far as Persia. In Rome the period was devoted to the Saturnalia, Sigillaria and Compitalia, the first of which lasted several days, and was celebrated in honor of Saturn, the god of agriculture. The feasting and gayety, the evergreen decorations, the fantastic processions of the mummers, and the custom of giving and receiving presents at this season, hav all come down to us unchanged from the ancient pagan festival of two thousand years ago. The Compitalia or plowman's feast, which closed the festivities in pre-Christian Rome, stil survives in the Plow Monday of England, following immediately after Twelfth-night. The custom of secretly putting presents into stockings belongs properly to the feast of Saint Nicholas (Santa Claus), December 6, and is supposed to be typical of that saint's practice of secret almsgiving. The transfer of the custom from the lesser to the greater holiday was natural and easy. In Ireland, as in other countries of Europe, the children hang up their stockings on Christmas eve to receiv the gifts which they ar told Santa Claus puts into them during the night, climbing down the chimney for the purpose. The Christmas tree is not a feature of the Irish observance. Presents ar also exchanged among the older ones, and on meeting at the chapel in the morning each seeks to make the first claim upon his neighbor by shouting, "My Christmas box on you!" at the same time wishing the customary "Merry Christmas and happy New Year." Presents ar also made on New Year, altho not to the same extent.

The ancient Germans and Scandinavians had, at this season, a festival

* W. S. (1811), in Pop. Sup., 82.

calld Yule, which was with them one of the principal occasions of the year. Fire seems to hav playd an important part in the Yule celebration, and Grimm is of the opinion that the Yule fire of the Germans was the equivalent of the Samhan fire of the Keltic nations.* The "Christmas log" and "Christmas candle," which ar kept burning from Christmas to Twelfth-night, ar common to Ireland, England and Scotland, the former being found also in France and among the Letts.† Speaking in this connection, Brand says: "I am pretty confident that the Yule block will be found, in its first use, to have been only a counterpart of the midsummer fires, made within doors because of the cold weather at this winter solstice, as those in the hot season, at the summer one, are kindled in the open air."‡

At this season of the year the druids of Gaul wer accustomd to repair to the woods to gather the mistletoe with much ceremony, but how far this practice was observd by their Irish brethren is not clear, altho the mistletoe was a sacred plant with ancient Kelts and Germans alike, being regarded as a great panacea and a promoter of fertility in cattle.

The Gaelic name of Christmas is *Nodlog* (*Nulloy*),§ and it is considerd at once the most joyous and the most solemn festival of the whole year. Everybody is up long before daylight, and it would be regarded as the greatest of misfortunes to be unable to attend early mass in the morning. Even the poorest strive to hav something better than common for the Christmas dinner, and this feeling is embodied in the Kerry proverb:

> Christmas day and the day of the turf,
> Them ar the days we'l eat enough,

alluding to the day on which the turf is cut, on which occasion the farmers hire a number of the poverty-stricken laborers to assist them, and always make it a point to give them a good dinner for once. As the general festivities, the giving of presents and hanging up of stockings by the little ones, hav already been noticed, we shal proceed to describe those features which savor more of a national character.

The mummers, as they ar calld, go about here as they do in England and on the continent, from Christmas to Twelfth-night. In appearance and manner they resemble the May boys already described in treating of May-day. Drest in fantastic style and singing verses suited to the occasion, they visit the houses of the farmers and gentry, and go through a whimsical dance or rude dramatic performance, with the aid of a piper and a "fool," the latter being frequently envelopt in the skin of a cow. Sometimes a sham battle is enacted by mounted warriors armed with wooden swords. In return for their efforts to amuse the people, they

* Grimm, Mythologie, i, 531 and 593.
† *Ibid.*, 594.
‡ Brand, Antiquities, i, 471.
§ Evidently the same as the French Noel, and perhaps, also, the German Yule.

expect a small reward at each house, and in this they ar seldom disappointed.

In the *Gentleman's Magazine* for 1824 we find an interesting description of a company of mummers, who had ventured to cross over to the vicinity of Dublin from their nativ parish on the other side of the bay. They seem to hav created as much alarm among the ruling powers as an army with banners, and the account furnishes an apt illustration of the combination of police surveillance and ponderous magisterial acumen that has so long prevaild in the Green Isle.

"They consisted of fifteen young men grotesquely attired in ribands, white shirts outside their clothes, papers and rosettes in their hats, and large sashes round their waists, and one was dressed in woman's clothes; two of them carried swords of a very ancient appearance; the remainder had sticks. Being noticed by the police landing from a boat, Peace-officer Sharpley proceeded to interrogate them; and considering it necessary to prevent such a formidable body from perambulating the district, immediately despatched a messenger to Mr. Goodison of the College Street office, who directed Peace-officer Campain and his party to proceed to Williamstown, when they took the whole number into custody as suspicious characters going through the country disguised. They were brought before Mr. Alderman Fleming and Sir Garret Neville, when one of them, Michael Darley, who stated himself to be the king of the party, said, that they came from Raheny, and that they had been out on the Christmas gambols since St. Stephen's day; that hearing there were a number of gentlemen's seats at the side of the water, he and his subjects undertook a voyage across the bay, to visit the shore of Williamstown and its vicinity. On being asked by Sir Garrett Neville where they got the swords, he said they got one from a man of the name of Neill, gardener to Mr. Joy, and the other from a person at Raheny, and that their intentions were entirely harmless; they assembled for the purpose of getting Christmas boxes, according to an ancient custom (in his dominions) at the other side of the water; and that the king and Hector (one of his guards) were always armed with swords. To a question by the magistrates, he said he was an historian, and his fool was treasurer, and carried a bladder fixed to a long pole; the party spent whatever they got in drinking, dancing and other amusements. They got money from Dean Ponsonby, Dean Gore, and many other gentlemen. 'His majesty' referred to Counsellor Casey for a character. The magistrates, after a severe admonition, had them detained for further examination." *

In Connemara the people "draw blood" on Christmas as on Saint Martin's day. The animal is kild the day before, but is not previously "named" as is the case when dedicated to the saint. So deeply rooted is this custom that poor people eagerly buy from the farmers old sheep which ar almost worthless, in order to kil them for this occasion, and

* Writer in Pop. Sup., 96, 97.

those who ar without money wil bind themselvs to do a certain amount of work in return for such an animal. While this eagerness is due in great part to the natural desire to hav a good dinner on Christmas at least, it may point also to sacrificial rites in connection with the old druidic celebration of the winter festival.

Every family that can possibly do so procures a large log known as the *bloc na Nodlog* (*bluc na Nullog*) or "Christmas block," to burn in the hearth-fire upon this day. The log is usually from the trunk of the resinous bog deal, now found only below the surface of the bogs. It is procured some time in advance, so as to be thoroughly dry for the occasion, and is sometimes kept burning at intervals until Twelfth-night. As previously stated, this custom, with that of the Christmas candle, is found also in other countries, and is evidently a survival of an ancient fire celebration.

The Christmas candle, which is usually kept lighted at intervals from Christmas to Twelfth-night, varies considerably in the different districts. In Connemara it is calld *truislán* (*thrushlawn*) and is made of twelv rushes plaited together and wrapt around with thread to prevent their untwisting in burning, the whole being dipt in melted tallow so as to form a large candle a yard or more in length. This is fixt upright on the table at supper on Christmas night (eve?) and allowd to burn for about an hour, when it is extinguisht, to be relighted in the same way on New Year's night and Twelfth-night. What remains is then put carefully away and preservd as a talisman to bring good luck to the house.

In many parts of the country the Christmas candles ar now supplied by the stores. They ar made of large size and variously colord, and in Kerry ar lighted on Christmas night and each night thereafter until Twelfth-night, inclusiv. On Twelfth-night they hav what is known as the *coinneal trí lad'rac'* (*cunyoel chre liarakh*) or "three-prongd candle," made by dividing the wick of an ordinary candle into three parts, which ar then dipt into melted tallow, so as to form three smaller candles above the large one. These ar all lighted simultaneously and gradually burn down to the main one, which continues to burn until extinguisht. A similar candle is described in Hall's "Ireland" as being burnd in Cork on Christmas eve until midnight, after which what remains is preservd as a safeguard against evil spirits.* It was probably originally used in the south, as in Connemara, during the whole period of the Christmas holidays.

On Twelfth-night, in Roscommon and the adjacent parts of Galway, rushes ar cut into pieces about six inches in length, which ar peeld from top to bottom, leaving only a thin strip of skin to prevent their breaking. These ar then dipt into melted lard or tallow and arranged in a circle around the edge of a cake of cow-dung, after which each member of the family selects one to represent himself. They ar then lighted, and it is believd that the lives of those present wil be long in proportion to the time occupied by the rushes in burning, he whose light goes out first be-

* Hall, Ireland, I, 25.

ing doomd to die soonest, and so on with the others. If there be more than twelv persons in the household, there ar an equal number of the rush candles, but there ar always at least twelv rushes. Piers describes a similar custom on this night as existing in Westmeath as far back as 1682, when a sieve of oats was set up in an elevated position and a lighted candle placed in the centre, surrounded by twelv smaller ones around the edge.* The twelv small candles surrounding a larger one, and the twelv rushes used in the same way in the west, had probably an astronomic significance in connection with the ancient pagan fire festival, altho they ar now explaind to be typical of Christ and His Apostles.

In the eastern districts there is a proverb that "a green Christmas makes a fat graveyard," as warm weather at this time of the year is believd to be unhealthy. Christmas night is not regarded as particularly sacred, but Christmas eve is held in high veneration, and no danger can come to any one walking out at that time, as no evil spirit has then the power to harm. On Twelfth-night, on the contrary, as on Saint John's eve and November eve, it is considerd unsafe to be out after dark. According to Lady Wilde,† the ass is said to kneel down in adoration of Christ on Christmas morning, and if one can manage to touch the cross on the animal's back at that moment, any wish of his heart wil be granted.

January 1, in the church calendar, is the feast of the circumcision, but its popular name of New Year points to a more remote origin in the pagan festival of Janus, the god of the year, represented on old sculptures as having two faces, one looking back over the year that is gon, the other looking forward to the new one coming on. No particular observances ar connected with the day beyond going to church and giving and receiving presents as on Christmas, the latter custom having come down from the ancient celebration. Strangely enough, the practice of giving presents was forbidden by the early church, but the popular custom proved too strong to be broken down.

As might naturally be expected in connection with the first day of the year, several interesting beliefs ar held in regard to New Year. He who gets up before sunrise on this morning wil not be lazy for one year—a statement which we can easily believ without any great stretch of the imagination. It is unlucky to pay out money, or to lend or giv anything —particularly fire—out of the house on this day, regular presents only excepted, as this would be to giv away the year's prosperity. This was also an ancient Roman belief in connection with the feast of Janus. In several districts, both north and south, it is customary to throw a pancake against the door to keep out hunger during the coming year, but this practice seems to be unknown in Galway.

If a woman be the first to enter the house on New Year, bad luck wil come to the inmates. In order to guard against such a misfortune two

* Piers, Westmeath, 124.

† Lady Wilde, ii. 107.

neighboring families sometimes arrange to hav a man from each house visit the other the first thing in the morning, and one man was said to get over the difficulty by making it a point to get up himself before daybreak and go through the door and back again. A similar belief exists in England.

In Galway and probably in other parts of the country, it is customary on New Year eve to put a stick into a stream or pool with a notch cut to indicate the hight of the water. If the water be above the mark in the morning—*i. e.*, should any rain fall during the night—provisions wil be high during the coming year. If the water be found to be below the notch, provisions wil be correspondingly low. As the Gaelic proverb has it, *Má éirig'eann an tuile, éirig'eann an buiseul, 'smá ísig'eann an tuile, tuituig'eann an buiseul,** "If the flood rises the bushel rises, and if the flood lowers the bushel falls." The same custom is practiced in Germany to determin whether the year wil be wet or dry.

Twelfth-night, January 6, is so calld on account of its being the twefth night after Christmas. It is also known as Little Christmas or Old Christmas, by reason of its being the date formerly fixt for Christmas before the adoption of the Gregorian calendar in 1752. Stil another name, used more especially in the south, is "Night of the Three Kings," as it is believd to hav been on this night that the magi from the East visited the infant Savior. In commemoration of this event the triple candle is lighted in Kerry, as already described, and it was formerly the custom also to bake a three-cornerd loaf or cake of bread on this day for the same reason, just as it is customary in England to bake a pie in the shape of a cradle and a cake in form like an infant on Christmas day.

On this night the cattle all kneel down and worship with their faces toward the east. In Kerry, it is said to hav been on Twelfth-night that Christ turnd water into wine at the marriage feast of Cana, and at a certain hour on this night every running stream is changed into wine. But no one must venture out to watch for the miracle, for two girls once went out to see the wonder and wer never heard of afterward. In Connemara, the change is believd to take place on New Year eve, and it is customary to begin the day by drinking a glass of water in honor of the event. In England, a similar miracle is said to occur on Saint Martin's night, November 11, the anniversary of the ancient feast of Bacchus, god of wine, a fact which is probably at the bottom of the modern belief.

The mummers go about with their songs and dances from Christmas until Twelfth-night, when the holidays come to an end. The national game of *camán*, or hurling, also holds a prominent place in the holiday sports in all parts of the country. The whole period is deemd sacred and no work that can possibly be postponed is done while it lasts. Each of the twelv days during this period is held to foreshadow the weather for the

* Pronounced: *Maw ireean an thuilya, ireean an bûshael, smaw eeshleean an thuilya, ishleean an bûshael.*

corresponding one of the twelv months of the coming year. Thus, should a snow storm occur on the day after Christmas, January wil be a month of snow; and if the day before New Year be mild and agreeable, so wil be the coming month of June. Now also might one bid farewel to the cares of the world without regret, for all who die during this blessed season go straight to paradise.

Bibliography.

Below is given a list of the authorities most frequently quoted in this paper, with the abbreviated forms used in order to avoid the repetition of long titles. Unless otherwise noted, the accounts here given of the origin of the various festivals ar taken from the first volume of Brand's valuable work on "Popular Antiquities:"

Brand, "Antiquities"—John Brand, "Observations on the Popular Antiquities of Great Britain," Bohn's edition, 3 vols., London, 1882–3.

Grimm, "Mythologie"—Jacob Grimm, "Deutsche Mythologie," 2 vols., Goettingen, third edition, 1854.

Hall, "Ireland"—Mr. and Mrs. S. C. Hall, "Ireland: Its Scenery, Character, etc." (or "Ireland: Picturesquely Illustrated"), 3 vols., new edition, New York, n.d. (about 1850), R. Worthington, importer.

Kelly, "Folk-lore"—Walter K. Kelly, "Curiosities of Indo-European Tradition and Folk-lore," London, 1863.

Lady Wilde—Lady Frances Speranza Wilde, "Ancient Legends, Mystic Charms and Superstitions of Ireland," 2 vols., London, 1887.

Piers, "Westmeath"—Sir Henry Piers, "Chorographical Description of the County of Westmeath," written in 1682, publisht in Vol. i of Vallancey's "Collectanea," 1774.

"Pop. Sup."—"Popular Superstitions," the Gentleman's Magazine Library, Boston, n.d., 1885. This is one of the series of volumes of classified selections from the *Gentleman's Magazine* from 1731 to 1868, edited by George L. Gomme, and publisht under the general title of "The Gentleman's Magazine Library."

Smiddy, "Druids"—Rev. Richard Smiddy, "An Essay on the Druids, the Ancient Churches and the Round Towers of Ireland," Dublin, 1871.

Vallancey, "Collectanea"—Charles Vallancey, "Collectanea de Rebus Hibernicis," 5 vols., Vols. iii and iv being each in two parts, Dublin, 1774–90. This is a collection of tracts relating to Ireland, including several written by Vallancey himself.

On the Inclinations of the Asteroids.

By Professor Daniel Kirkwood, Bloomington, Ind.

(*Read before the American Philosophical Society, May 17, 1889.*)

The forty-ninth page of my little volume on the Asteroids contains a brief statement respecting the orbital positions of these bodies, and the supposed connection between great eccentricity and high inclination. If the phenomena referred to have any bearing on the theory of asteroid formation—in other words, if facts hitherto regarded as isolated prove mutually dependent, may not their discussion point out new and unexpected relations? A more exact examination, at least, of these planetary statistics will not be without interest.

The first column of the following table gives the asteroids in groups of ten, in the order of distances; the second, the limits of the respective groups; and the third, the average inclination of the several clusters.

INCLINATIONS OF THE MINOR PLANETS.

Groups.	Distances.	Av. Inclinations of Groups.
1 to 10	2.13 — 2.28	3° 37′ 32.8″
11 — 20	2.28 — 2.36	7 0 22.1
21 — 30	2.36 — 2.38	11 0 13.9
31 — 40	2.38 — 2.40	12 20 15.2
41 — 50	2.40 — 2.43	6 44 48.1
51 — 60	2.43 — 2.45	5 25 7.4
61 — 70	2.45 — 2.56	7 20 51.5
71 — 80	2.56 — 2.58	10 19 23.2
81 — 90	2.58 — 2.616	9 27 49.3
91 — 100	2.616 — 2.647	8 10 43.1
101 — 110	2.647 — 2.667	7 2 53.5
111 — 120	2.667 — 2.685	8 4 11.0
121 — 130	2.685 — 2.712	9 25 17.1
131 — 140	2.712 — 2.737	8 2 6.1
141 — 150	2.737 — 2.745	10 10 30.0
151 — 160	2.745 — 2.762	8 36 12.7
161 — 170	2.762 — 2.771	11 23 0.2
171 — 180	2.771 — 2.799	10 36 6.2
181 — 190	2.799 — 2.870	8 16 7.1
191 — 200	2.870 — 2.921	8 10 4.8
201 — 210	2.921 — 3.012	7 23 35.3
211 — 220	3.012 — 3 06	7 48 19.0
221 — 230	3.06 — 3.11	5 54 43.0
231 — 240	3.11 — 3.126	8 48 52.6
241 — 250	3.126 — 3.14	7 0 36.9
251 — 260	3.14 — 3.185	10 46 51.3
261 — 270	3.185 — 3.42	8 39 16.8
271 — 280	3.42 — 4 24	6 28 26.3

REMARKS.

1. The average inclination of the first hundred (in the order of distance) is..... 8° 8′ 42.66″
Of the second hundred..... 8 58 38.87
Of the last eighty..... 7 51 20.15
And that of the whole two hundred and eighty. 8 21 34.87

2. The inclinations in the edges of the ring are less than the average.

3. Other *minima* are found about the distances 2.44 and 3.09. The *maximum* between 2.36 and 2.40 is distinctly marked.

4. As in the case of other planets, the inclinations vary, though with extreme slowness. It has not been shown, however, that the *average* will change to any great extent.

5. This average compares thus with certain other inclinations:
Mercury's orbit..... 7° 00′
Plane of the Sun's equator..... 7 15
Average inclination of asteroidal comets..... 16 40

6. The *maximum* inclinations of Mercury and Mars are 10° 36′ and 7° 28′ * respectively. The table indicates that *the mean inclination* of the asteroids has not differed greatly from the mean inclination of Mercury.

A Review of the North American Species of Hippotherium.

By E. D. Cope.

(*Read before the American Philosophical Society, May 3, 1889.*)

The relation of this genus to the other genera of Perissodactyla was indicated by Kowalewsky in his work on the genus Anthracotherium, published in the "Palæontographica" for 1874. He there showed that the genus occupies a place between Anchitherium and Equus in the genealogical phylum, as it does in geological time. In a paper on the "Systematic Arrangement of the Perissodactyla,"† the present writer placed Hippotherium in the family Palæotheriidæ, in a subfamily Hippotheriinæ, which was defined as follows: "Bicipital groove of humerus double; molars with cement in the valleys." This subfamily embraces the genera Hippotherium Kaup, and Protohippus Leidy. The Palæotheriidæ is here only distinguished as a whole from the Equidæ by the presence of perfect second and fifth digits.

The place of Hippotherium in the line of ancestry of the genus Equus

* Stockwell's Mem. on the Sec. Var. of the El. of the Eight Princ. Planets, Smith. Contrib. to Knowl., 232, p. 116.

† Proceedings American Philos. Soc., 1881, p. 399.

has been admitted by Kowalewsky, Huxley, Marsh and the writer. I have pointed out* that it is probable that the ancestry of some of the species of Equus can be traced to Hippidium, and therefore to Protohippus, as well as to Hippotherium, thus showing a diphyletic ancestry of the true horses. Mlle. Marie Pavlov† has devoted some care to the attempt to demonstrate that the latter genus could not have entered into this line. Her objections are derived from a consideration of the characters of the feet. Until however we know the structure of the feet in species of Hippotherium other than the *H. primigenium* of Europe, we cannot be positive as to the relation of particular species of that genus to particular species of Equus.

HIPPOTHERIUM Kaup.

Jahrbuch für Mineralogie, etc., 1833, 327 (description). Nova Acta Leop. 1835, xviii, 171–182. Jahrbuch f. Mineralogie, 1835, 622. Bronn Lethæa Geognostica, 1853–6, iii, p. 876.

Hipparion Christol. "Annales science d. Midi, 1832, March, May," name only, fide Bronn. "These sur les Brèches Osseuses, 1834, 26; Annales des Sciences Naturelles, 1835 *b*, v, 193," name only, fide Bronn.

Anterior interior column (protocone) of the superior molars distinct from the anterior interior crescent, hence giving an isolated dentinal area on attrition. Second and fifth digits present on both limbs, and of reduced size. Bicipital groove of humerus double. Metapodials without trochlear keel on the anterior face; third metatarsal without entocuneïform facet.

The preceding characters define a genus which had a general distribution over the Northern hemisphere during late Miocene and Pliocene time. It embraces a number of species, which were evidently present in droves in the countries where their remains are now found.

This genus and Protohippus include the latest representatives of the three toed horses, the lateral digits being reduced to small proportions. These genera represent also two types of dentition easily modifiable into Equus by slight alterations in the relations of the internal columns of the superior molars. In Hippotherium the coalescence of the internal columns has not been accomplished, for one of them remains in the isolated position of the internal cone of the symborodont type of dentition. In the species of the *H. occidentale* type, the anterior column is larger than the posterior, displaying considerable increase in the anteroposterior diameter. This is the character of the same column in Equus, and the junction of the column with the adjacent crescent is all that is necessary to convert the one genus into the other, so far as the superior molars are con-

* American Naturalist, 1887, p. 1075.

† Etudes sur l'Histoire Palæontologique des Ongulés; II. Le Development des Equidæ, Moscow, 1884.

cerned. In Protohippus, on the other hand, the junction has already taken place, but as the columns are of equal size, the pattern resulting is different from that of Equus. It is that of Hippidium, which, like Equus, has but one digit. An approach to Hippidium is seen in the species of Group II of the analytical table below, to one of which I gave the name of Stylonus. In this type the internal columns are of subequal proportions as in that genus. The posterior is joined to the corresponding internal crescent, and though the anterior column approaches very near to the anterior internal crescent by an apex of its section, it never does actually join. On the other hand, the posterior column is distinct in the just-protruded molar, and in the *H. seversum* remains distinct for a considerable part of the age of the animal.

The genus Hippodactylus* Cope, has the molar teeth of the general character of Hippotherium, but it possesses, like Hippidium, but one digit. The type is the *H. antelopinum* Falconer, of the Sivalik Upper Miocene of India. I think it not unlikely that when the skeletons of some of the species here referred to Hippotherium come to be known, that some of them will be found to belong to Hippodactylus.

History.—This genus was named by Christol and Kaup within about a year of each other, according to Bronn. I have not been able to refer to the essay in which the earliest name, that of Christol, was published, but according to Bronn, it was not accompanied by any generic description. In Kaup's first publication an attempt is made to characterize the genus, and although the description contains some errors, the important fact of its possessing dew-claws is mentioned. Two years later Kaup published a fuller and more accurate diagnosis. Christol does not appear to have ever given a description of the genus. The use of his name (Hipparion) does not therefore appear to be warranted.

Species.—The type is *Hippotherium primigenium*, the *Equus primigenius* of Von Meyer and the later *H. gracile* of Kaup. Its remains are common in the Mediterranean countries of Europe, and in France. A few other species have been discovered in the Old World. Their history has been elucidated by Wagner, Duvernoy, Gervais and others. North America has furnished a larger number of specific forms than any other country.

The American species of Hippotherium differ in the extent of the preorbital facial depression. In *H. speciosum* as in *H. primigenium*, the fossa is confined to the superior part of the facial region; in *H. isonesum* it extends downwards to the molar ridge, as in certain species of Protohippus.

The teeth of this genus are most frequently found in a well-preserved condition, and are hence most useful for purposes of determination. The species may be ascertained from those of the maxillary bone, though not without some difficulty. This is rather due to differences between the teeth of the same series than to the variability of the characters them-

* American Naturalist, 1888, p. 449.

selves. In the species successive modifications may be traced from the equine form of the genus represented by *H. occidentale* to that which approximates the genus Protohippus, represented by *H. sevcrsum*. In the former the anterior interior column is larger than the posterior, forms a more prominent rib on the inner face of the crown of the tooth, and is flattened or even concave on the inner side. After this form come others where the anterior column is round, and then others where it presents a ridge towards the anterior inner crescent, which in the worn section forms an apex or angle of the outline. The succeeding forms have the two inner columns of equal diameter and prominence, and though the anterior one maintains its distinctness its section projects in an angle towards the adjacent crescent. Finally we have the form where the subequal columns are both separated from their adjacent crescents, forming the supposed genus Stylonus Cope.

The internal columns in all the species become most longitudinally compressed in the posterior superior molars. The enamel borders of the lakes are frequently less complex in these teeth. In all the molars the apices of the crescents and columns are narrower in earlier than in later stages of wear, and the posterior inner column is sometimes separate for a short time. The enamel borders of the lakes become more complex also on wear, till middle age; they then, on further wear, become more simple.

In the following analytical table the characters of the fifteen species known to me from North American formations are set forth:

I. Anterior internal column of superior molars more prominent inwards than the posterior, larger, and not approaching union with the anterior internal crescent. *Hippotherium* Kaup.

A. Section of anterior internal column concave or flat on the internal side. Crowns prismatic.

a. Lake borders very complex; the loop nearly or quite isolated.

Grinding surface subquadrate; crown straight; larger; crown 25 mm. long; 24 mm. wide.....*H. occidentale.*
Like the last; smaller; grinding face 22 by 21 mm.....*H. montezumæ.*
Grinding surface oblong, 19 by 16 mm.; crown curved..*H. peninsulatum.*

aa. Lake borders simple; loop simple, open.

Grinding surface oblong, 22 by 19 mm.; crown nearly straight *H. sinclairii.*

AA. Section of anterior internal column oval.

a. Internal columns wide apart.

Grinding face subquadrate, 20 by 19 mm.; lakes of medium complexity.....*H. speciosum.*
Like the last, but lake borders highly complex.....*H. plicatile.*
Grinding face oblong, 22 by 21 mm.; lakes of medium complexity; column apiculate as in sect. Stylonus; p. m. iii elongate..*H. sphenodus.*
Grinding face oblong, smaller, 19 by 17 mm.; lakes of medium complexity; column entire.....*H. gratum.*

aa. Anterior internal column joining the posterior internal column.

Grinding face oblong, 20 by 17 mm.; lakes rather complex, with a large loop.....*H. retrusum.*

AAA. Section of anterior internal column round.

Larger; grinding face square, 19 by 20 mm.; complexity medium; posterior column not so prominent inwards.....*H. paniense.*

Smaller; grinding face longitudinal, 19 by 17 mm.; lakes complex; posterior internal column not prominent.....*H. venustum.*

Smaller; grinding face transverse, 16 by 19 mm.; posterior inner column nearly as prominent as anterior inner.....*H. relictum.*

II. Posterior internal column as prominent inwards and of nearly equal size with the anterior, and nearly cut off from the posterior inner crescent. Anterior inner column with an apex directed towards the anterior inner crescent. *Stylonus* Cope.

Large; grinding face 24 by 23 mm.; largest premolar short, wide *H. calamarium.*

Smaller; grinding face 20 by 18 mm.; largest premolar elongate, wedge-shaped.....*H. isonesum.*

Smallest; grinding face 17 by 17 mm.; lake borders simple..*H. seversum.*

The stratigraphic position of these species is as follows:

Lower Pliocene.
H. relictum Cope.
? *H. venustum* Leidy.

Ticholeptus bed.
H. seversum Cope.
H. isonesum Cope.

Loup Fork (Upper Miocene).
H. calamarium Cope.
H. paniense Cope.
H. retrusum Cope.
H. gratum Leidy.
H. sphenodus Cope.
H. plicatile Leidy (? horizon).
H. speciosum Leidy.
H. sinclairii Wortman (? horizon).
H. peninsulatum Cope.
H. montezumæ Leidy.
H. occidentale Leidy.

Of the preceding fourteen species I have seen teeth of all but the *H. venustum* of Leidy, which was found in the South Carolina phosphate beds. I have parts of several individuals of the *H. gratum* from Kansas, and the *H. retrusum* is from the same locality. *H. plicatile* is from Florida, and the *H. peninsulatum* and *H. montezumæ* are from Eastern Mexico. I have

but one molar each of *H. occidentale* and *H. sinclairii*, both from Cottonwood creek, Oregon. *H. speciosum* is the most abundant and widely distributed species; Leidy reporting it from Dakota, Nebraska and Texas, and its occurrence in New Mexico being recorded in my report to Lieut. Wheeler. Mr. Hill has since obtained fine specimens in Kansas. The *H. paniense* is known from a few teeth obtained by myself in Northeastern Colorado. The *H. calamarium* I found to be the predominating species in the Loup Fork beds near Santa Fé, New Mexico, and it is not rare in Northeastern Colorado. *H. isonesum* was apparently common in the Northwest, two fine specimens having been found by Mr. Wortman on the Cottonwood creek, Oregon, and one or more on the Deep river, Montana, by Mr. J. C. Isaac. *H. seversum* is so far only known from an Oregon specimen. The *H. relictum* has been so far also only found in Oregon.

Hippotherium occidentale Leidy.

Proceed. Academy Philada., 1858, 27. *Hipparion occidentale* Leidy, Proceed. Academy Phila., 1856, 59. Extinct Mammalia Dakota Nebraska, 1869, 281, 326, Pl. xviii, Figs. 1–5; xxvii, Fig. 2.

Known to me from a single superior molar tooth of the left side, found by Mr. Wortman on Cottonwood creek in Eastern Oregon.

The crown is very long, and almost rootless, and the cement layer is quite thick, especially towards the distal portion of the crown. The inner anterior column is flattened, and occupies a middle part of the fore and aft diameter of the crown. It is slightly crescentoid in section, and presents its anterior apex slightly inwards. The posterior inner lobe is not cut off from the inner crescent by any contraction. The lakes have their inner portions very prominent and marked off from the external portion by deep inflections of the border. There are two posterior and two interior inflections of the anterior crescent, and the adjacent ones of the two pairs nearly cut off a large loop, which thus occupies the centre of the crown. The posterior lake has two anterior and no interior inflections.

Measurements.

		M.
Length of crown		.056
Diameters of crown	anteroposterior	.024
	transverse	.024

I suspect that the *Hippotherium affine* Leidy (Extinct Mammalia, Dakota and Nebraska, p. 286) is based on young individuals or represents a slight variety of this species.

Hippotherium sinclairii Wortman.

Revue Scientifique, Paris, 1883, p. 712.

I know a single left superior molar of this species. It is easily distinguished from the corresponding tooth of *H. occidentale* by its inferior size

and relatively smaller transverse diameter. Its dimensions are about those of the *H. speciosum*, but it differs from that species in the larger and flatter inner column, longer crown, and less complex folds of the borders of the lakes.

The crown is long and nearly straight, as in *H. occidentale*. In its present condition there is but little external cementum, which may be a result of weathering, nevertheless that which remains in the grooves of the inner side does not form a thick layer. The outlines of the lakes are not extended inwards as in *H. occidentale*, and the transverse diameter of the latter is relatively small. The anterior lake has one posterior inflection, one interior and one anterior; of the posterior lake there are two anterior, none interior and one posterior; a short loop extends towards the inner column area. The latter is convex on the outer side, and without trace of angle or apex.

Measurements.

		M.
Length of crown		.043
Diameters of crown	anteroposterior	.021
	transverse	.019

Discovered by J. L. Wortman on Cottonwood creek, Eastern Oregon.

HIPPOTHERIUM MONTEZUMÆ Leidy.

Proceedings Academy Philadelphia, 1882, p. 297. *H. rectidens* Cope, Proceedings American Philosophical Society, 1886, p. 360.

This species is known from two superior molar teeth, one of which is in the possession of Dr. Joseph Leidy, and the other is in my private cabinet. It is nearly allied to the *H. occidentale*, but is smaller, and the enamel borders of the lakes are rather more complex. The internal column is longitudinal in section, and the internal face is slightly concave. The posterior column is quite small, and is well defined from the posterior inner crescent by a deep posterior sinus. Two strong loops project towards the internal column from the adjacent enamel border. The lakes have a deep emargination on each of their distant enamel borders, and a number of loops on their approximated borders. One of these, which represents the largest excurrent loop of other species, is of unusual size and prominence, and is nearly isolated by the constriction of its isthmus. In my specimen it is touched by the apex of an excurrent loop of the posterior lake; in Dr. Leidy's, it can be traced to a connection with the anterior lake, which is probably the normal relation. Lakes not much expanded transversely to the crown.

The crowns of both specimens are prismatic. That of mine is nearly straight; Dr. Leidy's is slightly curved, but not so much so as in the *H. peninsulatum*.

		MM.
Diameters of crown	transverse	21.5
	anteroposterior	21.5
	longitudinal	450.0

From Tehuichila, State of Vera Cruz, Mexico, on the borders of Hidalgo; from a bed of Loup Fork age.

HIPPOTHERIUM PENINSULATUM Cope.

Proceedings American Philosophical Society, 1885, p. 150, Fig. 1.

Crown of superior molar long, curved. Grinding face with anteroposterior diameter considerably exceeding the transverse. Internal column large, its section a narrow anteroposterior oval, with both borders convex. Internal enamel borders of internal crescents with a prominent loop at junction, the posterior one with its posterior loop much smaller than the column. A subquadrate area between the internal parts of the lakes is connected by an enamel ridge with the anterior lake. Opposite and adjacent enamel borders of the lakes, with several close and deep plications, which nearly cut off the adjacent horns. In like manner the posterior horn of the posterior lake, and the anterior horn of the anterior lake are almost cut off by the deep complex infolding of the anterior and posterior borders respectively. The median and anterior external ribs of the crown are well developed, and there is but little cement on the grooves.

Measurements.		M.
Length of root, less crown		.050
Diameters of grinding face	anteroposterior	.018
	transverse	.015

This superior molar tooth indicates a small species of the genus, and one which is entirely typical in form. The plication of the enamel is greater than any other species excepting the *H. gracile*. It resembles the *H. venustum* of Leidy, which is of similar dimensions. In that species the style has a nearly circular section according to Leidy, which distinguishes it satisfactorily. It approximates the *H. montezumæ* in the character of its plications, but the oblong form, small size and greater curvature distinguish it.

From the Loup Fork shales of Tehuichila, Vera Cruz.

HIPPOTHERIUM SPECIOSUM Leidy.

Cope, Bulletin U. S. Geolog. Survey Terrs., No. 1, p. 12, Jan., 1874. Report Expl. Surv. W. of 100th Meridian, Vol. iii, p. 322, Pl. lxxv, Fig. 3, 1877.

Hipparion speciosum Leidy. Proceed. Phila. Academy, 1858, p. 27; Extinct Mamm., Dakota and Nebraska, p. 282, Pl. xviii, Figs. 6-19, 1869.

Hippodon speciosus Leidy. Proceed. Phila. Academy, 1854, p. 90.

This species appears to have been pretty generally distributed over Western North America, excepting the extreme Northwest. Among the numerous specimens sent me from Montana and Oregon, I have not recognized any as belonging to this animal. The species has been heretofore known by teeth only, in spite of its relative abundance; but my party in Northern Kansas, under Mr. Hill, obtained an almost perfect cranium accompanied by three cervical, four dorsal and one lumbar vertebræ, and part of the sacrum; with parts of foreleg and foot and one-half the pelvis. A superior molar of a second individual, from the same locality, is accompanied by a mandible with teeth, and bones of various parts of the skeleton. An opportunity for determining the general characters of this horse is now first presented.

Skull—form.—The cranium is about the size of that of the black-tailed deer (*Cariacus macrotis*). The profile of the front is nearly straight, with a slight convexity in front of the infraorbital region. The latter is flat or a little concave in both directions as far on each side as a line drawn anteriorly from the temporal fossæ; from these lines it slopes to the orbital border, flat posteriorly, becoming convex anteriorly, strongly so above the lachrymal bones. The profile of the parietal region descends steeply to a point above the meatus auditorius externus, and rising again into a prominent sagittal crest, joins the inion at the extremity of another descending slope. The inion is somewhat truncated at the summit. The anterior part of the sagittal crest is low, and divides at a very acute angle above the middle of the glenoid cavity. The horizontal angle of the malar and maxillary bones is prominent, extending forwards nearly to the anterior part of the first true molar. The preorbital fossa is limited in extent, occupying a position above the infraorbital foramen. Its sides rise gradually except on the upper border, which is abrupt. The muzzle is not excavated anterior to the fossa, but the usual contraction of the border of the diastema is strong. The acumination of the apices of the nasal bones is on their inner sides, and extends as far forwards as the line of the canine teeth. The notch of the nostrils extends to a point above the anterior border of the second (first large) premolar.

The zygomata are slender and little expanded, they are compressed behind. The orbital portion is triangular in section behind, with an external and a superior plane. The orbit is large and a little deeper than wide, the width equaling just one-fourth the distance from its posterior border to the extremity of the nasal bone. The postfrontal process presents its edge outwards and its broadsides directly fore and aft. The occipital region is rather contracted above. Its superior half is occupied by a median keel. The paroccipital process is long, extending considerably below the occipital condyles, and is compressed, presenting its sides outwards and inwards. A narrow strip of the os petrosum is exposed between the occipital and squamosal bones, extending as high up as the postinial fora-

men. The posttympanic process is distinct but short, presenting an obtuse edge outwards, which is separated from the petrous by a groove. The tympanic forms with the superficial layer of the petrous, a tube which encloses the tympanum, and which separates widely the posttympanic and postglenoid processes. The postglenoid is confined to the inner half of the posterior border of the glenoid cavity, and rises obliquely inwards to its apex. The inner border is vertical.

The palate is moderately flat, and is excavated behind as far as opposite the middle of the penultimate molar. The diastema in front of the canine is just half as long as that posterior to it. The width of the palate at the antepenultimate premolar is just twice the width of that tooth. The protuberance of the maxillary bone behind the last molar is about as long as the fore and aft diameter of the last molar. The pterygoid process of the palatine is not very long, and is slightly everted. Its superior border is thickened and somewhat roughened, and descends posteriorly without hamular process. The pterygoid wing of the sphenoid forms a prominent ridge directed downwards and forwards, which encloses the large alisphenoid canal. The pterygoid bone is a delicate scale at the inner side of the pterygoid ala, which extends as far back as the posterior alisphenoid foramen. The basioccipital and basisphenoid are convex in cross-section. The anterior part of the former is compressed, and the posterior part of the latter presents two low truncate tuberosities, outwards, backwards and downwards. The presphenoid region is contracted in the form of a part cylinder, which is underroofed by the laminar posterior part of the vomer, which extends nearly as far posteriorly at the sides as the posterior alisphenoid foramen.

Sutures.—The sutures are distinct in this skull. That separating the premaxillary and nasal bones is considerable, being about half as long as the nasomaxillary suture posterior to it. The nasolachrymal suture is about as long as the nasopremaxillary, and differs from it in being straight instead of convex upwards. The nasal bones are widened behind so as to be decurved laterally to the lachrymal. The posterior nasal sutures are each convex backwards. The lambdoidal suture crosses the sagittal crest in front of the inion and reaches the squamosal at the postparietal foramen. The postfrontal is only in contact with the zygomatic process of the squamosal, and at considerable distance posterior to the malar above, but opposite the posterior inferior slip of the malar. The latter bone extends as far forwards as the middle of the penultimate molar, and rises upwards nearly to the middle of the orbit. The lachrymal bone is a very large one ; it is a little higher than the facial part of the malar, and extends a little further anteriorly. Its frontal suture is shorter than its nasal, and extends nearly to the middle of the superior border of the orbit. The premaxillo-maxillary suture passes into the incisive foramen at the canine tooth. The maxillopalatine extends forwards as far as the front of the first true molar, and posteriorly near to the last molar to the shallow groove between the maxillary bone and the pterygoid process.

Foramina.—The infraorbital is of good size, and issues above the posterior part of the fourth premolar. The lachrymal is rather large, and occupies a space but little below the middle of the lachrymal. The posterior infraorbital is large. The supraorbital is double and pierces the base of the postfrontal process. There are two postparietals of rather large size, and at least one large postsquamosal. A well-developed though narrow tentorial ridge defines the position of the lateral venous sinus in front. The mastoid foramen is, as in modern horses, not enclosed posteriorly on its external side, but winds round upwards and forwards, grooving the part of the petrous bone which rises within the mastoid. The *meatus auditorius* is small and the supraglenoid is large, but not so large as the postglenoid. There is but one, a large condylar foramen. The jugular, carotid and oval foramina are not distinguished from the *foramen lacerum*. The *f. f. opticum* and *sphenoörbitale* are distinct and close together; the *f. rotundum* is further back, entering the skull within the alisphenoid canal. The orbitonareal perforation is quite large, and is posterior to the posterior infraorbital canal, not having a common entrance with it as in the species of Equus. There is but one palatine foramen on each side, whose posterior borders are nearly in line with the anterior border of the nareal excavation. The incisive foramina do not extend posterior to the position of the nareal excavation. There is a small foramen on the median line just in front of them.

Dentition.—The condition of the teeth shows that the individual described had just reached maturity, since the last molar is not worn on the posterior part of its face. The cups of the incisors are fully enclosed, but the posterior part of the border of the third is not produced quite as far as that of the other teeth, and does not display such results of wear. The cup of the first is filled with cement; of the second and third not fully, but with a median fissure remaining. The size of the incisors decreases from the first to the third, not increases, as, *e. g.*, in *Equus quagga*. The canines are small, and have the equine sharp borders bounded by two grooves of the inner side.

The fourth premolar is two-rooted, but is small and is more than half overlapped by the third. The latter is not remarkably large nor particularly elongate. It is, however, relatively longer than in *H. calamarium*, where it is very wide. The molars diminish posteriorly by very little, the last being distinctly smaller. The internal free column of the molars has a longitudinally oval section, and its middle is a little anterior to the middle of the crown. It has a small apiculate angle directed forwards and outwards. On the large third premolar it has a round section, and joins the internal anterior crescent by a very narrow isthmus. The posterior column is connected with the posterior inner crescent by a narrow isthmus in all the molars, and has in all the flattened form of the anterior column. The lakes as usual are enclosed, and the crescents communicating; this is true of the third premolar as of the others, except that the anterior lake opens forwards and inwards. The adjacent borders of

the lakes are complicated, and so is the posterior border of the posterior lake; the anterior border of the anterior lake is simple. There are two or three loops on the posterior border of the anterior lake, the inner one of which is deep, and nearly or quite reaches the ends of one or two deep loops which enter from the inner border. These nearly or quite cut off a large lobe into a small subround lakelet. This is present on all the teeth and is seen in Dr. Leidy's figure of his typical specimen, though not quite so strongly marked. It is also present but less marked in the New Mexican specimen I have described.* There are four or five inflections of the anterior border of the second lake, and two or three of the inner border at its posterior part. The external ridges of the crowns are well developed, and the cement layer on the external and internal faces of the crowns, as well as in the lakes, is uninterrupted. The crowns do not display any part of the roots, and their wear is in two shallow grooves, a median and a posterior.

Measurements of Cranium.

	M.
Length below (including condyles)	.315
" from edge of incisor i to extremity of maxillary bone	.220
Length from edge of incisor i to extremity of palate	.170
" " " " fourth premolar (axial)	.078
" " " " canine (axial)	.044
" of zygomatic fossa	.055
" from incisor i to edge of orbit	.190
" " nostril " " "	.115
" " anterior edge of orbit to top of inion	.150
Horizontal diameter of orbit	.048
Width between orbits above (direct)	.087
Greatest width of zygomata	.130
Width of muzzle above preorbital fossæ	.040
" " " " nareal angle	.032
" between third incisors	.037
" " diastemata posteriorly	.027
" " third premolars	.034
" " last true molars	.050
" " pterygoid crests at postalisphenoid foramen	.021
" " apices of postglenoid processes	.070
" of occipital condyles	.050
" " foramen magnum	.022
" " occiput at summit	.030
" " " " mastoid foramina	.062
Length of molar series	.125
" " third premolar	.025
Width " " " (greatest)	.014

* Report U. S. G. G. Survey W. 100th Mer., Vol. iv, p. 322, Pl. lxxv, Fig. 3.

Measurements of Cranium.

		M.
Length of true molar series		.0565
Diameter of second true molar	anteroposterior	.020
	transverse	.020
Diameters second premolar	anteroposterior	.022
	transverse	.022

Vertebræ.—The axis is preserved except the anterior part of the centrum, which is wanting. The posterior cup is deep and oblique, and the hypapophysial keel is strong, acute and well produced posteriorly. The neural spine is, as usual, a keel which is well produced forwards. Its superior border is thin and is arched, the greatest elevation being a little anterior to the middle. A tuberous ridge descends on each side to the base of the postzygapophysis. The latter are large, and with articular surfaces a little oblique. The parapophyses originate at the middle of the centrum, and are quite narrow and acuminate in form, their apices reaching beyond the line of the superior border of the cup of the centrum. The vertebrarterial canal is not enclosed; it is represented by a groove with a narrow angular edge below. Its anterior marginal perforation is enclosed by a narrow bridge. This vertebra differs from that of *Equus caballus* in the greater anterior extension and greater acuteness and form of border of the neural canal; in the narrowness and deep separation of the parapophysis, and non-enclosure of the vertebrarterial canal.

The seventh cervical is not perforate for the vertebral canal. The extremities of the rather depressed diapophyses are thickened and a little recurved, and their bases send a thin keel posteriorly along the side to the costal articulation. While the cup is subround, the ball is compressed, and its surface extends over the anterior two-fifths of the base of the centrum. The hypapophysial keel is marked and acute, and rises to a tubercle at the middle of its length. The zygapophyses are large, the posterior plane and a little oblique; the anterior more oblique, and a little concave. Neural spine compressed and very short.

The dorsal vertebræ are distinctly opisthocoelous, and their sides and inferior edge are gently concave. The hypapophysial keel appears on the posterior centra. The diapophyses have the usual form, are on the superior part of the neural arch, are directed upwards, and support an obtuse metapophysis. Just posterior to their base is situated the double spinous foramen. On posterior dorsals this foramen becomes single and is situated above the line of the base of the diapophysis. In one of the latter vertebræ there is a fossa in the anterior costal fossa. The neural spines become very elevated posteriorly, are narrow in front and shallowly grooved behind. The anterior ones are slightly concave in anterior outline. The postzygapophyses are merely oval facets at the base of the spine; the prezygapophyses are not well defined.

The last lumbar is opisthocoelous and has a much depressed centrum. Its diapophyses are very wide in both directions, and bear articular faces

on both the anterior and posterior borders for adjacent diapophyses. The posterior are larger, and are transverse oval. The postzygapophyses are prominent, but narrow; the prezygapophyses have a vertical external face and concave internal face; the superior border is not rolled in as in Booïdea. No hypapophysis. The anterior two elements of the sacrum are preserved, the rest having been lost. They are thoroughly coössified, and the intervertebral foramina are large. The prezygapophyses are like those of the last lumbar. The iliac surface only extends on two centra.

A comparison of the dorsal vertebræ with those of the horse shows that those of this species are more tapiroid in the general isolation of the spinous foramina in the anterior part of the column.

Measurements.

	M.
Elevation of axis at middle	.055
" of spine of do., from roof of arch behind	.015
" of neural canal of do., behind	.014
Length of spine on side	.049
Width of cup of axis	.021
Length of centrum last cervical	.045
Diameter ball of do., vertical	.018
Diameter ball of do., horizontal	.014
Expanse of postzygapophyses do.	.041
Elevation of neural spine from canal	.024
Diameters centrum anterior dorsal, fore and aft.	.024
Diameters centrum anterior dorsal, anterior, vertical	.016
Diameters centrum anterior dorsal, anterior, transverse	.024
Length of neural spine from canal in front	.063
Length centrum of a posterior dorsal	.028
Width anteriorly without costal faces	.018
Depth " " " "	.017
Length of neural spine from canal anteriorly	.107
Diameters last lumbar, long	.030
Diameters last lumbar, anteriorly, vertical	.015
Diameters last lumbar, anteriorly, transverse	.023
Anteroposterior width of diapophysis of do.	.035
Total expanse of sacrum in front	.098
Depth of centrum of do., anteriorly	.013
Width of neural canal in front	.020

Anterior limb.—About the distal half of the humerus is preserved. Its form is much like that of the horse, the inner side being flat, and the outer concave at the position occupied by the epicondyle when present. The external supracondylar ridge is distinct but not prominent. The trochlear crest has the same position as in the horse, and is rather more prominent. The condylar surface exterior to it is not cut off above and

behind by a groove, as in the horse. The superior grooved boundary of the internal condylar face is better defined. The ulnar and radial shafts are co ssified, but the head of the radius is not united with the ulna, though in contact. Distad to this contact, is a considerable interosseous space, relatively longer than in the horse. The line of contact of the head of the radius is convex downwards in the middle. Olecranon much compressed. The carpal articulation of the radius is like that of the horse. The scapho-lunar ridge is transverse; the scaphoid surface recurved below, and a fossa behind the lunar surface. The convex superior surface of the bone has five facets, two of which are more or less lateral.

The left metacarpus and *os magnum* are preserved; the magnum has a relatively smaller transverse diameter than in the horse; its posterior tuberosity is also narrower. The facets of the inter side are much less pronounced than in the horse, the whole being divided by an anteroposterior groove. On the internal side the two anterior or trapezoid facets are as large as in the horse, while the posterior facet of the recent animal is absent from the *H. speciosum*. The magnum facet of the metacarpal is uninterrupted, not divided, as in the horse. The two unciform facets are much more oblique than in the horse. The trapezoides differs considerably from that of the horse. It has but one facet below, and that one is continuous with that of the metacarpal. It sends posteriorly a hook-like process. Above, it encloses no foramen with the magnum. The bevels for the lateral metacarpals are distinct throughout the bone. The posterior face is divided distally by a median obtuse ridge into two shallow gutters, a character not seen in the horse. There is no trace of the trochlear keel on the anterior face of the distal extremity. The section of the shaft at the middle is at least a semicircle. The phalanges of the middle toe have the form usual among these animals. They are rather more slender than in some of the allied species, as *H. isonesum*, and the proximal inferior triangular surface is more produced, reaching to the end of the proximal two-fifths of the length. It forms a large triangular face, concave in the middle.

Measurements of Fore Limb.		M.
Diameters of humeral condyles	anteroposterior at inner side	.045
	" at middle	.021
	transverse	.040
Depth of ulna at edge of head of radius		.019
Distal width of radius		.038
" depth of radius (greatest)		.024
Diameters of scaphoid facet	anteroposterior	.016
	transverse	.016
Diameters of lunar facet	anteroposterior	.014
	transverse	.016
Diameters of os magnum	anteroposterior	.023
	transverse	.023
	longitudinal	.011

Measurements of Fore Limb.		M.
Anteroposterior width trapezoides	external	.015
	internal	.011
Length of median metacarpal		.164
Proximal diameter	transverse (total)	.025
	anteroposterior	.017
Diameters of middle of shaft cannon bone	anteroposterior	.015
	transverse	.017
Length proximal phalange		.044
Proximal width of do		.026
Length of second phalange		.025
Proximal width do		.024
Length proximal lateral phalange (measured at middle)		.023
" ungual " " " "		.018

The phalanges just measured are presumed to belong to the anterior limb because no bones distinctively of the posterior limb were preserved in the collection.

The *os innominatum* differs in a number of respects from that of the horse, although its general characters are equine. The peduncle of the ilium is long and slender and subtriangular in section, and the ischium has a long anteroposterior diameter. The postacetabular crest is prominent, but not very acute. The pubis is subcylindric in section, and is not concave above as in the horse. The posterior bifurcation of the ischia is not so extensive as in the horse. Pectineal ridge more prominent than in the horse.

Measurements of Innominatum.	M.
Length of ilium from fossa lig. teris to edge of crest	.130
Diameter of peduncle externally at middle	.024
" " acetabulum (long)	.033
Length of ischiopubic median suture	.065
" " obturator foramen	.040
" " ischium remaining posterior to obturator foramen	.042

The preceding measurements show that the *Hippotherium speciosum* was about the size of the *Antilocapra americana* or pronghorn Antelope, but had relatively more robust limbs and a shorter neck.

Hippotherium plicatile Leidy.

Proceedings Academy Philadelphia, 1887, p. 309, Fig. × ½.

This species is represented by two superior molar teeth and probably by numerous bones, in the collection of Prof. Jos. Leidy. They are all from the Loup Fork bed of Florida. The crowns of the molar teeth are elongate and nearly straight. The anterior internal column is median in

position, and is much more prominent than the posterior. Its section is subregular oval. The posterior column is a large process of the posterior inner crescent. The lakes are expanded transversely and their remote borders have the usual deep notch. The adjacent borders are very complex with rather shallow inflections, with the usual large loop of the anterior lake represented by two narrow excurrent folds with irregular borders. The crowns wider than long.

		MM.
Diameters of grinding face (Leidy)	anteroposterior	20
	transverse	23

This species possesses teeth of the *H. speciosum* type, but with such a distinct style of enamel plication as to preclude the idea of identity with that species.

From near Archer, Florida, Dr. Neal.

Hippotherium gratum Leidy.

Extinct Mammalia of Dakota and Nebraska, p. 287, Plate xviii, Figs. 25, 30. *Hippotherium ingenuum* Leidy, Proceeds. Acad. Phila., 1885, p. 33, Fig.

This species is represented in my collection by two superior molars with lower jaws of three individuals, and two posterior superior molars of another individual from the Loup Fork bed of Northern Kansas. Dr. Leidy examined five superior molars from the corresponding horizon of Northern Nebraska.

These specimens indicate a small species of general affinity to the *H. speciosum*. The internal column is prominent at or before the middle of the crown in position, and of regular oval section. The posterior internal column is small and not prominent, and is well defined externally by a deep sinus. The opposed borders of the lakes are folded into several narrow sinuses, and the loop of the anterior lake is large and subround. The plication is of intermediate character. The posterior face of the crown of the last superior molar is deeply grooved longitudinally. In a pair of these molars which are well worn, the adjacent borders of the lakes have reduced their plications to serrations, and the loop to a prominent convexity. The posterior lobe is still well defined, and the anterior internal column touches the anterior internal crescent. The difference between these and typical teeth is as great as that distinguishing species, but I believe it is due solely to wear. A similar simplification is seen in the *H. paniense* and *H. speciosum*.

		MM.
Diameters of a superior molar	anteroposterior	19
	transverse	18
Diameters of a last sup. molar, little worn	anteroposterior	19
	transverse	14
Diameters of a last sup. molar, much worn	anteroposterior	18
	transverse	16

The mandibular rami which probably belong to this species present the character of an uninterrupted series of canine and incisor teeth. The symphysis is contracted, and the rami increase rapidly in depth. The diastema is long. No trace of fourth premolar.

Measuremen's.

	MM.
Length of symphysis	37
" " diastema	46
Depth of ramus at posterior border of p. m. iv	40

HIPPOTHERIUM RETRUSUM Cope.

This species is represented in my collection by eight molars, two from one and six from another animal. These are associated with two superior molars with somewhat different characters, which are intermediate between those of *H. gratum* and *H. speciosum*. All were found in the same locality, but separated from their positions in the skull. The two molars first above mentioned are about half worn, and present the characters of the species best. The other six (with one exception) are less worn, and present a less complex folding of the enamel plates. Five of them are from one side, and one (more worn) from the other side of the jaws.

The character by which the superior molars of the *Hippotherium retrusum* may be readily distinguished from those of all other species of the genus, is the extraordinary posterior extension of the anterior internal column, which brings it first into contact with the posterior internal column, and then on greater wear unites the two by an isthmus. In the first true molar the area of the column is in contact at its extremities with both the posterior column and the anterior inner crescent, leaving a narrow oval area (or lake) within it, cut off at both extremities. In the second molar the column is only in contact with the posterior internal crescent, with which it is united by an isthmus. In both the molars the posterior inner column is well distinguished by the usual deep sinus from the posterior inner crescent. The character above described is an exaggeration of what is distantly approached by the last superior molar in some of the species.

The complexity of the enamel border of the lake is of medium degree. The anterior lake has on its posterior border a large more or less completely isolated wide loop. Exterior to it the adjacent borders of both lakes are thrown into narrow anteroposterior folds. No fold on remote border of anterior lake, and a weak one at the corresponding position on the posterior lake. A short small loop towards the internal column on m. ii. The crowns are robust, of medium length, and curved. That of the second true molar is rather longer than wide; the first true molar is about as wide as long.

Measurements of Superior Molars.

		MM.
Diameters m. i	anteroposterior	19
	transverse	18.5
	longitudinal	26
Diameters m. ii	anteroposterior	20
	transverse	18
	longitudinal	36

The anterior inner column presents in the second individual the same flattened form as in the first above described, but it is connected with the anterior crescent by a narrow isthmus, and not in two of three teeth at least, where the part is preserved, with the posterior crescent. The anterior molar (third premolar from behind) has this junction a complete fusion of the two. As one of these teeth is a true molar it is possible that they represent another species.

The animal last described may possibly belong to a species distinct from the *H. retrusum*, and perhaps to a species of Protohippus or Hippidium. If so, it differs from the known species of those genera in the posterior position and flatness of the anterior column. In that case it may be called *P.* or *H. profectus*. It approaches nearer to Equus than any known species of those genera.

Measurements of No. 2.

		MM.
Diameters of p. m. i	anteroposterior	45
	transverse	23
	longitudinal	19
Diameters of m. iii	anteroposterior	24
	transverse	20
	longitudinal	36

In dimensions this species is then about equal to the *H. speciosum*.

From Phillips county, Kansas, from the Loup Fork bed. Frank Hazard.

HIPPOTHERIUM PANIENSE Cope.

Bulletin U. S. Geolog. Survey Terrs. (Hayden), No. 1, 1874, p. 12. Annual Report U. S. Geolog. Survey Terrs., 1873 (1874), p. 522.

This species is known from molar teeth from the Loup Fork beds of N. E. Colorado. The enamel borders differ in their degree of complexity according to the amount of wear to which they have been subjected.

In the molar which presents the more simple type of enamel borders, the posterior internal column is entirely fused with the posterior inner crescent. The anterior inner column is therefore alone. It is nearly round in section, and presents no angular apex towards the inner crescents, and there is only a trace of the loop which is usually directed towards it from the enamel border connecting the crescents. The borders

of the lakes only show indication of plication on their adjacent faces; here the anterior has traces of three loops and the posterior of one. Cementum full within and without.

A second superior molar is not so much worn, and displays more plication of the enamel plates. The crown is curved and not elongate. The posterior inner column is not lost, and the anterior column is not so round in section, but is a short oval. It presents no angle towards the enamel borders of the inner crescents, but there projects a single small loop opposite the middle of the column. The folds of the lakes are confined to their adjacent faces, thus agreeing with the tooth No. 1. The folds are also very few, but much deeper than in No. 1. On the posterior lake there are three, the inner one deep; on the anterior lake, one deep one, and another rather deep entering from the inner side approaches it. Slight undulations of the posterior border of the posterior crescent take the place of the folds of other species.

The *Hippotherium paniense* evidently differs from the other species in the coincident cylindric form of its internal column, with the greater simplicity of its enamel plates.

Measurements.

No. 1.	M.
Length of crown on middle of side	.012
Diameters grinding face { anteroposterior	.020
Diameters grinding face { transverse	.021
" inner column	.005

No. 2.	
Length of crown on middle of side	.016
Diameters grinding face { anteroposterior	.019
Diameters grinding face { transverse	.020
" of inner column	.005

I obtained the teeth of this species in 1873 from the Loup Fork beds of the Pawnee Buttes in Northeastern Colorado.

Hippotherium venustum Leidy.

Proceedings Academy Phila., 1853, vi, p. 241; Holmes, Post Pliocene Fossils of South Carolina, 1859, p. 105, Plate xvi, Figs. 32–3.

For the character of this species I am compelled to rely on Leidy's figures above cited, as the description at the latter reference cited (there is none at the first) gives no assistance.

According to the figures in question, the anterior internal column is median in position, and is nearly round in section. The posterior internal column is small and loop-shaped in section. A single narrow loop of the middle enamel border is directed towards the anterior internal column. The lakes both have the usual inflection of the border on their remote

sides. The adjacent borders are much inflected with simple deep folds, and there is not represented to be any material difference between the larger loops towards the inner sides of the lakes.

The species is one of the smallest of the genus, being about equal to the *H. peninsulatum*. The crowns are represented to be elongate and but little curved. Grinding face longer than wide, 19 by 17 mm.

Deposits of Ashley river, near Charleston, South Carolina. The fossils of this deposit are of mixed ages, so that it is impossible to fix its true horizon with certainty.

Hippotherium relictum Cope.

American Naturalist, March, 1889.

Crowns of superior molars as broad as, or broader, than long, rather short and moderately curved. Anterior internal column with a broadly oval section, without angle, and well separated from adjacent enamel borders. Posterior internal column on the first true molar, projecting as far inwards as the anterior, but broadly connected with the posterior internal crescent. It is not so far inward in the last superior molar, with which it is connected by a rather narrow isthmus. The enamel border of the lakes is very simple, consisting in the first true molar of one or two emarginations of the adjacent faces, and one or more of the remote margins. A loop of the posterior internal border of the lakes is outlined. A small loop directed towards the anterior internal column. Cementum layer thick.

Dimensions of Molars.

		MM.
Diameters m. i	anteroposterior	16
	transverse	19
Diameters m. iii	anteroposterior	17
	transverse	18.5
Diameters m. i, inferior	anteroposterior	17
	transverse	8
Diameters m. iii, inferior	anteroposterior	18.5
	transverse	8

From a Lower Pliocene bed (? Idaho terrane) of the eastern part of Oregon. George C. Duncan.

Hippotherium sphenodus Cope.

Hippotherium speciosum Leidy, Cope, Bulletin U. S. Geol. Survey Terrs., No. 1, 1874. Annual Report U. S. Geol. Survey Terrs., 1873 (1874), p. 522; not of Leidy.

Two superior molars of this species were obtained by me in the same locality as that furnishing the *H. paniense*, and at the same time. Several years later I obtained two other molars from the same place, viz., the Pawnee Buttes of N. E. Colorado.

Their characters are somewhat similar to those of *H. speciosum* in the plications of the enamel, but the form of the internal columns is entirely distinct, referring the species to the group of the *H. calamarium*. The latter species is, however, distinguished by the very short wide form of the anterior teeth, especially of the second premolar. While noting this character in the Report of Lieut. Wheeler, as above cited, I did not regard it as specific. Having obtained another similar specimen, I am now inclined to attach more importance to it. It indicates that the *H. calamarium* exhibited a greater facial concavity at the diastema than any other species known from this country.

In this species the anterior distinct column has an oval section with an angle directed to the anterior inner crescent. The enamel border connecting the crescents sends towards the column two loops. The borders of the lakes are plicate on their inner and adjacent sides. The front of the anterior lake has a deep notch, and three still deeper ones enter from the posterior inner border. There are two others on the posterior outline. The adjacent face of the posterior lake has four inflections, and there are two deep ones on the posterior part of the inner border. The posterior crescent sends an angle backwards, which is separated from the posterior inner column by a deep notch. The third premolar is narrowed and somewhat produced forwards, and its anterior inner column though distinct is reached by the narrow loop of the inner enamel border. The anterior inner crescent is peculiar in being distinct and isolated, so that the cementum of the anterior lake communicates with that covering the anterior inner side of the tooth. In the second and less worn specimen, the two lakes also have a narrow communication. The former character is found in *H. calamarium* and *H. isonesum*, but not in *H. speciosum*.

Measurements.

	No. 1.	M.
Diameters crown third premolar	longitudinal	.018
	anteroposterior	.025
	transverse at column	.019
Diameters crown left molar	longitudinal	.015
	anteroposterior	.022
	transverse	.021

	No. 2.	
Diameters crown second premolar	longitudinal	.028
	anteroposterior	.025
	transverse at column	.014
Diameters crown right superior molar	longitudinal	.019
	anteroposterior	.022
	transverse at column	.022

The specimen No. 1 equals that of *H. speciosum* in dimensions; No. 2 is a little larger.

Hippotherium calamarium Cope.

Annual Report of U. S. Chief of Engineers, 1875, ii, p. 990. Report U. S. G. G. Survey W. of 100th Mer., G. M. Wheeler, p. 321, Pl. lxxv, Figs. 1-2.

With this species we enter the group characterized by the general equality in size and form of the anterior and posterior internal columns of the superior molars, and the presence of a rudiment in the anterior column, of an isthmus corresponding with that one which connects the posterior inner column with the posterior inner crescent.

The *H. calamarium* has been found especially abundant in the Loup Fork bed of Pojuaque near Santa Fé, New Mexico, and I have a portion of a maxillary bone supporting two molars, from the corresponding horizon of Northeast Colorado, which may be placed here provisionally in the absence of the third superior premolar. The borders of the lakes are of medium complexity only, and the posterior loop of the anterior lake is rounded, and is not much constricted. The anterior inner crescent of the third (anterior) premolar is isolated. This tooth differs from the corresponding one of the *H. sphenodus* and the *H. isonesum* in its short, wide form. Should the latter character be found not constant, I do not know of any way of distinguishing it from the latter. In the former the posterior internal column is less prominent and smaller, much as in *H. speciosum*, etc. Cementum layer thick. Crowns nearly square, short, curved.

Measurements of Specimen from Colorado.

		MM.
Diameters of m. i	anteroposterior	24
	transverse	24

Hippotherium isonesum Cope.

Hippotherium severum Cope, Proceeds. Amer. Philos. Society, 1886, 359, not of 1878, p. 76.

Judging from the relative abundance of specimens, this was the common species of the far Northwest of the United States during the Upper Miocene period. I have the large part of a skeleton with skull from Cottonwood creek, Oregon; parts of maxillary bones with teeth of a second individual from the same locality, with some teeth of a third from the same. There are a good many teeth of the same species from the Tricholeptus bed of the valley of Deep river, Montana, a number of which belong to one individual.

In the subequal characters of the two inner columns of the superior molars, the species betrays an approach to Protohippus, which is emphasized by the angular projection of the anterior column towards the anterior internal crescent. The two however never join, and only come into contact in one instance, in the third premolar of a Montana specimen.

As the skull belongs to an animal not quite adult, I describe the dental characters from the second individual mentioned as having been sent from the same locality in Oregon. In this one it is observable that the inner edges of the cups of the incisors are well developed, but the latter are only partly filled with cementum. The fourth premolar is two-rooted and is half overlapped by the third. The latter is of usual form, produced anteriorly. The anterior inner crescent is distinct from the posterior inner, but is narrowly connected with the anterior outer. The lakes have a narrow communication. In the molars of typical form the posterior internal column is almost cut off from the adjacent crescent by the deep posterior notch or loop, which also narrows the posterior crescent at this point. The borders of the lakes are not much complicated in this specimen. They display on the third premolar only one well-marked inflection on their adjacent faces, and two (one minute) on the posterior part of the internal border in both. The posterior extremity of the posterior internal crescent sends an angle inwards along the edge of the crown. One or two loops point towards the internal column.

In the Montana series, the premolars and first true molar of one side are preserved, and two true molars of the opposite side. Their crowns are less worn than those just described, and the enamel borders of the lakes display more numerous inflections. Thus the anterior border of the posterior lake has three deep inflections, while the adjacent boundary of the anterior lake has but one; this one however bounds a loop by nearly joining another deep notch entering from the inner posterior direction. Then there is a deep notch in each lake coming from the direction of the anterior and posterior margins of the crown respectively. One loop extends towards the inner column.

In the Oregon skull, already mentioned, the superior molars display different degrees of wear in such a way as to be very instructive. The premolars are least worn; and in them we observe (1) that the posterior internal column is distinct from the adjacent crescent like the anterior one; (2) that the mutual connections between the internal crescents are very narrow; and (3) that the inflections of the borders of the lakes are few and shallow. In the second true molar, which is a little more worn, there is one deep inflection on the adjacent border of each lake, of which the anterior one nearly cuts off a loop by approaching a notch from the inner side. In the first true molar, which is, of course, the most worn, the posterior lake has the full number of three notches on its anterior border.

The masticating surface of the molars of this species is worn into transverse angular grooves and ridges more distinctly than in any other species of the genus.

The *cranium*, already mentioned, is somewhat distorted by pressure, but many characters are clear. The facial concavity is different from that of *H. speciosum* in its greater size and more posterior extension, and also in its expansion downwards to the maxillo-malar ridge, as in certain

species of Protohippus. The postorbital process turns its edge outwards. The external extremity of the glenoid cavity is quite prominent. The posttympanic process is short and acute. The palatine foramina are opposite the posterior edge of the first true molar. The supraorbital foramen is large and distinct. The infraorbital foramen issues above the middle of the fourth premolar. The palate is as narrow as in *H. calamarium*, but the premolar teeth are narrower; the greatest transverse diameter of the second premolar in *H. isonesum* is two-thirds that of the palate between them while it is equal in *H. calamarium*.

Measurements of Skull.

	M.
Length from incisors to occipital condyles	.328
" " to glenoid surface (axial)	.257
" " to end of os maxillare	.210
" " to p.m. iv (axial)	.068
" " to canine "	.037
Transverse diameter of orbit	.044
Width at paroccipital processes	.034
" between first true molars	.044
" " second premolars	.030
" at diastema near p.m. iv	.028
Long diameter p. m. iv	.013
Diameters p.m. iii { anteroposterior	.024
Diameters p.m. iii { transverse (at column)	.014
Diameters m. i. . { anteroposterior	.019
Diameters m. i. . { transverse	.019
Long diameter of crown of I. i	.013

The only *vertebra* of this individual, which is well preserved, is an atlas. This one has the general proportions of that of the horse, but differs materially in the less anterior extent of the transverse process. This does not, as in the horse, enclose the anterior arterial foramen, which is therefore represented by a notch. The hypapophysis is well marked, and the condyloid cavity deeply notched on the external side. The first dorsal is strongly opisthocoelous, its ball is subquadrate. There is a strong obtuse hypapophysial ridge. The anterior capitular articulation is large and flat.

The last two lumbars are preserved somewhat injured. They are united mutually and with the first sacral by rather large articular surfaces of the diapophyses. The penultimate has an obtuse hypapophysial keel, which is less distinct in the last one.

Measurements.

	M.
Length of atlas on side	.052
Expanse of atlas transversely	.086
Width of canal behind	.023

Measurements.

		M.
Diameter of ball of d. 1	vertical	.018
	transverse	.018
Diameters of ball of a posterior lumbar	vertical	.016
	transverse	.027

The larger part of the *pelvis* is preserved. It agrees with that of *H. speciosum* and differs from that of the horse in the subcylindric pubes, but it differs from that of the former in having the peduncles of the ilium flatter or deeper fore and aft. The peduncles of the ischium are robust, and are concave on the outer and convex on the inner side, less convex, however, than in the horse. The obturator foramen is a more elongate oval.

Measurements.

	M.
Length of ilium	.150
" of pubis	.045
" of obturator foramen	.040
Width of ischia at end of foramen	.060
" of acetabulum vertically	.033

Both *femora* are preserved. They display the usual equine characters of long great trochanter and large third trochanter, which is half opposite the inferior half of the prominent keel-shaped small trochanter. The shaft is robust, rather compressed and slightly curved fore and aft. Its section at the middle is an anteroposterior oval. The internal crest of the rotular groove is higher than the external posteriorly, and projects as well a little inwards; it is not, however, developed to anything like the extent seen in the horse. The rotular groove is rather wide and is cut off from the external condyle only by a fossa. The intercondylar fossa is rather wide. The supracondylar fossa is large and of subcircular form; it marks one-third the distance between the condyle and the third trochanter.

Measurements of Femur.

	M.
Total length (axial)	.260
Elevation of great trochanter	.030
Length from apex of great trochanter to middle of third trochanter	.096
Width at head	.068
" " third trochanter (middle)	.052
" of shaft at middle	.022
" at condyles	.050
Transverse diameter of shaft at middle	.031

The *tibia* is not so robust in its proportions as that of the horse or quagga, but is about as in the *Anchitherium præstans*. It is smaller than

the tibia of the latter, although the sizes of the crowns of the teeth in the two species is about the same. The crest is narrower and more prominent than that of the horse and quagga, and similar to that of the *A. præstans*. It differs from that of the latter in the entire coössification of the distal extremity of the fibula and entire absence of the splint-like shaft seen in the adult *A. præstans*. The spine is well marked and widely divided, and the external anterior notch is deep. The popliteal fossa is well marked. The shaft is flattened from side to side, and presents an obtuse edge outwards along the middle of its length. It is not marked by muscular and other impressions as in *Anchitherium præstans*. The distal end is much like that of the species just named; both differ from those of the horse and quagga in having the internal tuberosity of a more oblong form and less prominent.

Measurements of Tibia.

		M.
Total length		.253
Diameters of head	anteroposterior	.047
	transverse	.060
Diameters of middle of shaft	anteroposterior	.020
	transverse	.028
Diameters of distal extremity	anteroposterior	.023
	transverse	.041

The *tarsus* is represented by calcaneum, astragalus, navicular and ectocuneïform. The first two do not differ from the corresponding bones of an undetermined Protohippus beyond their somewhat smaller size, excepting in the better developed calcaneal facet on the external margin of the astragalus. The astragalus agrees with that of the undetermined Protohippus, and differs from that of the horse in three points: (1st) The less extension inward of the distal tuberosity and navicular facet; (2d) the greater compression of the trochlear keels; (3d) the distinct extension of the prominent inferior margin of the internal superior trochlear smooth surface, to the internal distal tuberosity. The quagga is intermediate in these points. The facets of both surfaces of the navicular are not so much subdivided as in the horse, but more so, as to the upper surface at least, than in the *Anchitherium præstans*. Its anterior portion is not so expanded outwards as in the horse, but is considerably more so than in *A. præstans*, and about as in Protohippus. The same statements apply to the ectocuneïform. The superior facets are divided as in the horse, but inferiorly the posterior facet is a branch of the anterior, not distinct from it as in the living species.

Measurements of Tarsus.

	M.
Length of calcaneum	.070
" " sustentaculum	.049
Greatest width of calcaneum	.030
Depth of sustentaculum at middle	.028

Measurements of Tarsus.	M.
Greatest diameters of astragalus { anteroposterior	.038
Greatest diameters of astragalus { transverse	.035
Width between centres of trochlear crests	.015
Transverse extent of navicular facet	.021
" " " cuboid	.006
Diameters of navicular { longitudinal	.008
Diameters of navicular { anteroposterior	.024
Diameters of navicular { transverse	.027
Diameters of ectocuneiform { longitudinal	.007
Diameters of ectocuneiform { anteroposterior	.019
Diameters of ectocuneiform { transverse	.025

The *metatarsals* are smaller than those of the undetermined Protohippus and still smaller than those of *Anchitherium præstans*. The third is of generally similar form in all three of the species, though the proximal extremity has not quite so much anteroposterior width in *H. isonesum* as in the other species. In all of them it is more convex than in the horse. It also differs from that of the horse in not having the posterior facet cut off from the anterior. It is partially cut off by a deep sinus in this species and the undetermined Protohippus, which sinus is only represented by a notch in *A. præstans*. The lateral metatarsals are slender medially as in the undetermined Protohippus, and not so stout nor so much compressed in *Anchitherium præstans*. They do not quite reach to the articular surface of the median metatarsal, being a very little shorter than in the Protohippus and Anchitherium mentioned. The phalanges of the *H. isonesum* have about the same diameter as those of the undetermined Protohippus, but they are distinctly shorter, especially the pastern. The coffin bone differs from that of the same species in the smaller size of the proximal lateral fossæ.

Measurements of Foot.	M.
Length of m.t. iii	.175
Proximal diameters m.t. iii { anteroposterior	.019
Proximal diameters m.t. iii { transverse	.025
Diameters shaft m.t. iii { anteroposterior	.015
Diameters shaft m.t. iii { transverse	.018
Distal diameter m. t. iii { anteroposterior	.019
Distal diameter m. t. iii { transverse	.021
Length m. t. iv	.159
Anteroposterior diameter m. t. iv, proximally	.020
" " " ii, "	.014
" " " ii, medially	.006
Length of pastern laterally	.033
Width of do. distally	.019
Length of coronary on side	.025
Width of do. distally	.019
Length of coffin bone in front	.031
Expanse of do. posteriorly	.030

This three-toed horse was of about the size of the *Hippotherium speciosum*, which I have already shown to have been equal to the prong-horned antelope, but of somewhat different proportions.

This species stands in a certain relation to the *Protohippus insignis* Leidy, a species which is common in the Eastern beds of Loup Fork age. Should the anterior internal column unite with the anterior internal crescent, thus developing the character of the genus Protohippus, it is doubtful whether the two species would be distinguishable by the dentition. I have not seen, however, any intermediate specimens, and the two species occupy different geographical areas. A somewhat similar relation exists between the *H. sphenodus* and the *P. perditus*, but in the former the enamel lake borders are much more complex.

Hippotherium seversum Cope.

Stylonus seversus Cope, Paleontolog. Bulletin, No. 30, p. 14. Proceed. Amer. Philos. Society, 1878, p. 76.

The *H. seversum* was originally described from a superior molar, which though worn over the entire grinding face of the crown still retains the posterior column distinct from the posterior inner crescent. On this account I distinguished the species generically from Hippotherium under the generic name Stylonus. I think, however, that a little further wear would reveal the union between the two parts of the crown above mentioned, which would then present characters not distinguishable from those of Hippotherium.

Crown of superior molar moderately elongate and curved. Grinding face subquadrate. External ridges prominent. Section of anterior internal column oval, with an apex directed outwards at a short distance anterior to the single internal median loop. Posterior internal column also oval in section, distinct from posterior internal crescent, and without apiculate angle in specimen at present state of wear. Crescents narrow, separated by rather wide lakes entirely filled with cementum. Lake borders simple; anterior with a trace only of anterior notch; posterior with a strong posterior notch. Opposed adjacent borders with one notch on the posterior and two on the anterior crescents, the latter enclosing a small loop in the usual position. External cement layer rather thin.

Measurements.

		MM.
Diameters crown	anteroposterior	18
	transverse	17
	longitudinal	28

Ticholeptus bed of Cottonwood creek, Oregon; Dr. J. L. Wortman.

This species differs from both the *H. isonesum* and *H. calamarium* in its inferior dimensions, and in the simplicity of its enamel lake borders.

PROC. AMER. PHILOS. SOC. XXVI. 130. 3F. PRINTED SEPT. 11, 1889.

EXPLANATION OF PLATES.

Figures of superior molar teeth of species of Hippotherium, natural size.

Fig. 1. *Hippotherium occidentale* Leidy; superior molar, from Cottonwood creek, Oregon; internal view; *a*, grinding face.
Fig. 2. *H. sinclairii* Wortman; inner view; *a*, grinding face.
Fig. 3. *H. rectidens* Cope; side view; *a*, grinding face.
Fig. 4. *H. peninsulatum* Cope; side view; *a*, grinding face.
Fig. 5. *H. speciosum* Leidy; including canine and incisor teeth. From Kansas.
Fig. 6. *H. plicatile* Leidy; grinding face; from Leidy.
Figs. 7–8. *H. retrusum* Cope; first and second molars, grinding faces; *a*, posterior view of 7. From Kansas.
Figs. 9–12. Superior molars doubtfully referred to *H. retrusum* or to *Protohippus* or *Hippidium profectum;* grinding faces. From Kansas.
Figs. 13–14. *H. paniense* Cope, from Colorado; *a*, posterior view of 13.
Fig. 15. *H. calamarium* Cope, from New Mexico; from Cope in Report Expl. Surv. W. of 100th Mer.; G. M. Wheeler.
Figs. 16–17. *H. gratum* Leidy, from Kansas; *a*, anterior view of 16, which is an m. iii, little worn. 17. *a*, posterior do. of 17, much worn.
Fig. 18. *H. venustum* Leidy, from South Carolina; grinding face; *a*, interior view. From Leidy.
Figs. 19–20. *H. relictum* Cope, from Oregon; *a*, anterior view of 19.
Figs. 21–22. *H. sphenodus* Cope, from Colorado. 22. Anterior premolar.
Fig. 23. *H. isonesum* Cope, from Oregon; including canine and incisor teeth.
Fig. 24. *H. seversum* Cope, from Oregon; *a*, posterior side.

Note on Hippotherium rectidens. By E. D. Cope.

In the preceding monograph of the genus Hippotherium, I have stated that the *H. rectidens* Cope is probably founded on a tooth of the *H. montezumæ* Leidy. A renewed examination of the type of the former convinces me that I was premature in reaching this conclusion. Besides the straightness of the crown, the *H. rectidens* possesses a peculiarity not shared by any other species of the genus. The loop, or principal lobe of the lake margins, belongs to the posterior lake, and not to the anterior lake. The latter is its connection in *H. montezumæ*, and in all other species of the genus known to me. It is represented on Plate i, Fig. 3.

An Account of the Congo Independent State.

By Henry Phillips, Jr.

(*Read before the American Philosophical Society, November 2, 1888, and February 1, 1889.*)

HISTORY.

The creation of the Congo Independent State may be considered as one of the most curious and most characteristic episodes of the nineteenth century. All settlements formerly made in unexplored countries were the results of missionary labors, or of wealth- or fame-seeking adventurers. Motives of policy on the part of European governments then came into play to facilitate the reduction and colonization of the new-found lands. To no such causes was the founding of the Congo Independent State indebted, neither religious fervor nor thirst of gold caused it to see the light. The philanthropy of the King of the Belgians, together with his love of geographical explorations, were to be the means of pouring the light of civilization upon "the dark continent."

It was not even upon the soil of Africa that the Congo Independent State took its origin: its birth place was at Bruxelles, in the palace of a monarch.

On the 12th of September, 1876, King Leopold the Second, of Belgium, held at his royal residence, in Bruxelles, a conference of the most celebrated modern geographers and the most famous explorers of all nations, to discuss and to formulate the best methods of planting firmly on the soil of the African continent the standard of civilization. This assemblage laid the foundation of the "*Association Internationale Africaine*," which subsequently selected for the field of its labors that portion of "the black continent" lying between the western coast and the great lakes of Central Africa.

Two years later, on November 25, 1878, under the auspices of His Majesty, was held a second congress, "*Le Comité d'études du Haut-Congo*," whose object was to penetrate barbarous Africa by ascending the Congo river, whose course had lately been ascertained by Stanley, and to seek practicable means of establishing regular communications along the Upper and Lower Congo, and to create amicable relations for commercial purposes with the tribes that dwelt in the interior, offering to them, in exchange for their objects of value, the varied productions of European industry. Under the auspices of this Society, formed of English, French and Belgian philanthropists and capitalists, the explorer, Stanley, undertook his voyages. The amicable measures pursued by the agents of the Association caused the indigenous populations to look with a friendly eye on the new scheme, and an uninterrupted chain of stations was created

and maintained along the whole course of the river; no violence, no usurpations, no disrespect of the rights of the native chiefs were permitted, none took place, and the result was the peaceable establishment of settlements whose future was assured.

The philanthropic and scientific ends of the "*Comité d'Etudes*" became interwoven with a political idea, that of founding in the very heart of Africa an immense independent State, and the Comité changed its name and became henceforth "*L'Association Internationale du Congo.*" Under this title the Society redoubled its efforts, and by the end of the year 1883, it had concluded with the various independent chiefs of the Congo basin, and that of the "Niadi Kwilu," more than one thousand treaties, by which the native chieftains ceded to it all their territorial rights over the immense domains included within the before-mentioned boundaries.

It now remained only to obtain from the civilized nations some recognition of this new arrival among States; the very first successful negotiations to that effect were with the United States of America; on the 10th of April, 1884, the Senate of the United States authorized the President to recognize the standard of the International Association of the Congo as fully as that of any other friendly government. On November 8, 1884, the Emperor of Germany authorized a similar recognition. Subsequently the conference at Berlin was opened "to regulate, in an amicable spirit and with cordiality, the conditions that could assure the development of the commerce of the Congo, and arrange for the prevention of errors and mutual misunderstandings." Diplomatic relations were sought with all the powers that had sent agents to this conference, resulting in the ultimate recognition, by them, of the new State, and, on February 26, 1885, *The Congo International Association* itself gave in its adherence to the resolutions formulated by the conference. Prince Bismarck, in announcing the recognition at the end of the conference, said, "I think that I may express the sentiments of this assemblage in saluting, with satisfaction, this act of the Congo Association. To the new State is to be entrusted the work that we have outlined, and I breathe my most hearty wishes for its prosperous development and for the fulfillment of the grand ideas of its illustrious and noble founder."

But one thing now remained, the official nomination of the sovereign of the Congo Independent State; a choice already made by the logic of accomplished facts and the unanimous voice of public opinion. With a universal approbation, His Majesty, Leopold II, desired his ministers to recommend to the chambers to pass a law, that, in conformance with Article LXII of the Belgian Constitution, would permit him to accept the sovereignty of another State, and the authorization was granted in the following terms: "Sa Majesté LEOPOLD II, Roi des Belges, est autorisé à être le Chef de l'Etat fondé en Afrique par l'Association Internationale du Congo. L'Union entre la Belgique et le nouvel État sera exclusivement personnelle."

On the 1st of August, 1885, His Majesty, Leopold II, King of the Bel-

gians, notified the powers of the foundation of the Congo Independent State.

THE BERLIN CONFERENCE.

While the Association Internationale Africaine was opening the route to Central Africa, *via* Zanzibar, the Comité d'Etudes du Haut-Congo was carrying on its explorations along that river, and the Association Internationale du Congo was investigating the basin of the Congo and acquiring territorial domains and rights of sovereignty. Portugal still asserted her ancient although shadowy and undetermined pretensions over the western coast and the interior. England sided with Portugal, and France, entering by the river Ogooué, sought to become master of the river beyond the stations already established by the Association; Germany seized a number of points on the western coast, and commercial houses founded by Dutch, English, Germans and Americans continued their operations on the Lower Congo or the sea coast, and their mutual encroachments could, at any moment, give rise to their respective governments, a pretext for intervention, and become a source of grave trouble, danger, and even of bloodshed. In order to compose these conflicting interests, France and Germany took the initiative towards assembling a conference, at which should be represented all the nations that had commercial relations on the Congo; fourteen powers responded, *viz.*, Germany, Austria-Hungary, Belgium, Denmark, Spain, the United States of America, France, Great Britain, Italy, The Netherlands, Russia, Sweden and Norway, Portugal, and Turkey.

The conference opened at Berlin on November 15, 1884, and on February 26, 1885, the plenipotentiaries of the powers assembled, signed an act of which the following is a resumé.

Liberty of Conscience is assured by the first section for the whole immense basin of the Congo, which is admitted without being confused by natural, orographic boundaries; for twenty years no entry-duties shall be charged on any goods. The Association Internationale du Congo has, in its treaties with the principal nations, declared that at no time shall any import duties be levied within its possessions. An export duty representing from 3 to 4% of their commercial value is levied by the Congo Independent State on eight indigenous products. All privileges of exit are likewise granted without any favoritisms to flag or cargo. All strangers are to have equal rights of liberty, freedom of conscience; the aborigines are to be protected in the peaceful possession of their rights and property.

The perpetual proscription of slavery is a fundamental dogma of public law in all the colonies situated in the basin of the Congo; no slave shall be permitted to be sold, no slave mart to be established, on the territory.

The States that have arisen or may arise in the basin of the Congo, and the powers desirous of colonizing, have a right to declare such colonies

under the protection of neutrality, either perpetual or temporary. The Congo Independent State has availed itself of the privilege and has declared *itself forever* to be a neutralized State.

The navigation of the Congo and of its affluents is to be free. No fluvial or maritime toll is to be established along its course. Taxes must only be sufficient to compensate for the expenses of keeping the river navigable and of keeping up the establishments placed on its banks. An International Committee, at which all the high contracting powers have the right of being represented, is to be especially charged with supervising the liberty of navigation and transit upon a footing of the strictest equality; it must also keep the streams, etc., in good condition, and carry on all necessary work of all kinds which, in time of war, shall be held inviolable and not to be disturbed.

The Congo is to remain navigable, *even in war-time*, to vessels of all nations, whether belligerent or neutral, and *private property is to be respected even if under an enemy's flag.*

The navigation of the Niger and its affluents is rendered free under the same stipulations as that of the Congo, except that the administration of the river is entrusted to those owning Riparian rights, with authority to act separately.

Conditions of future occupancy. All future taking possession of territory on the coasts of Africa must be publicly notified, and to be effective must be actual.

Modifications and changes are provided for in the last section of this Act, which must be agreed to by the powers in conference, and other States may be admitted to this agreement upon an equal footing.

LIMITS, POPULATION, ETC.

The boundaries of the Congo Independent State are: *1. On the north*, by the French and Portuguese possessions, determined by the course of the Tshiloango, the Congo and the Ubangi, up to the junction of the fourth parallel, north latitude, with the thirtieth degree of longitude east from Greenwich. *2. On the east*, by a line following the latter degree to the north-eastern shore of Lake Mwutu Nzige, and to the eastern borders of Lakes Tanganyika, Moëro and Banguelo. *3. On the south*, by the dividing ridge between the basins of the Congo and the Zambese to the twenty-second degree of longitude east of Greenwich; then from south to north by the line of the waters of the River *Kassai* to the sixth parallel of south latitude, along which it runs to the sea. *4. On the west*, by the Atlantic ocean, from the mouth of the Congo to the Bay of Cabinda.

The territory embraced within these limits comprises two millions of square kilomètres, and is estimated to contain some twenty millions of inhabitants, or about ten to the square kilomètre.

The tribes dwelling within this region are independent and are subject each to its own chief, to whom Europeans usually give the title of king, although his subjects may be but few in number. As a rule, the dwellers near the coast are of a peaceable disposition, but of course those more

remote from contact with the whites are more savage and more bellicose. Some of these tribes are man-eaters, and it is stated that, curiously enough, the people who practice this custom are neither among the most ferocious nor those the least amenable to the influences of civilization. With the advent of the Europeans, their customs soon become modified, and it often happens that cannibalism disappears, without any intervention on the part of the whites, by mere force of contact.

Barter is carried on with the natives, who are very skillful in trading being full of subterfuges, and lengthy negotiations are necessary to obtain from the merchants the greatest possible amount of value for the very least equivalent.

Agriculture does not flourish, except so far as concerns products absolutely necessary for their daily life; women and slaves alone work on the plantations, the men but very rarely taking a hand in such labors, and only when a great exertion is needed.

Among the blacks employed by traders may be found types of all tribes as far as Cape Lopez, and some few from the interior of the continent.

The strongest and best workers are the "Kroo-boys" (from the coast of Kroo, near Cape Palmas), whence they derive their name. All of these blacks speak some English, and some few of them a little French. They receive from five to seven dollars a month, and board and lodging; they are usually engaged for eighteen months, after which they are paid their wages, either in goods or cash, as they may desire; the majority generally receive about two-thirds in merchandise. Like other black workmen, they are fond of heavy goods of cotton, and of various colors, table and pocket knives, umbrellas, flintlock guns, powder, tafia, gin, pearls, felt and straw hats, jewelry, second-hand military and naval uniforms, razors, soaps, combs.

The Cabindas act as sailors and domestic servants.

The Loangos are joiners, ship and house carpenters, and coopers.

The smiths, masons and brickworkers come from the English colony, on the Gold Coast.

In the employ of the Congo Independent State are also natives of Zanzibar, Haoussa and some from the head-waters of the Niger.

The negroes have no religious belief, but are given to fetishes, of which the chief are the good genius, or the Creator, and the evil one, or the Devil. These are represented by rudely carved idols and adorned with shields and tatters. Additionally each negro carries about his neck or waist small objects of veneration, or talismans.*

* According to a recent traveler, "A curiously-shaped idol, either female or fashioned like a priapus, can still be found at all cross-roads. It is generally a foot in height and stands on a round pedestal raised upon a pole a yard from the ground. In front a flat stone supports a basket, into which passing market people and all who have concluded a bargain make a point of dropping grain or other food, which any starving or destitute person is at liberty to eat."

The same authority states: On the Island of Kimeh, the sacred burial place for ages of the Wabuma chiefs, were many fetishes, "figures of various sizes, all of them equally hideous and obscene." (Bateman.)

THE JOURNEY UP THE CONGO RIVER.

Coming from the high sea, the first land sighted is a low sandy coast, fringed with verdure as a background, later a red clay; here is Point Pedraô. Further is Shark's point, opposite which, on the right bank of the river, lies

BANANA.

This is the first of the settlements of the Congo Independent State passed on going up the Congo river, which, at its mouth, is eleven to twelve kilom. wide. Here is a long range of white "factories," built on piles, and the port is accessible to vessels not drawing more than six metres of water; the rise of the tide is 1M.80. This harbor is claimed to be the best between the Congo river and the Cape of Good Hope. Although pilotage be free, an official service has been organized by the Independent Congo State. Every vessel of more than 500 tons, entering Banana, is to pay a fixed tax of 150 fr., which is intended to cover the State for the expenses incurred by the placing of buoys, the building of lighthouses, etc. On paying this due, ships may receive a pilot of the State to take them in and out the harbor without any extra charge. Up to Boma and return pilotage tax is 300 fr. for four days. For each exceeding day an extra charge of 50 fr. is to be paid. Houses, both for dwelling and store-houses, have been built of brick and wood; a hotel has been erected by the Dutch Co. where travelers are boarded and lodged for seven shillings a day.

The chief commercial houses here are as follows:

1. The Dutch Co., having its home office at Rotterdam; founded in 1869, covers a territory of 700 arpents; employs at Banana thirty whites and 800 blacks; has forty stations along the river.

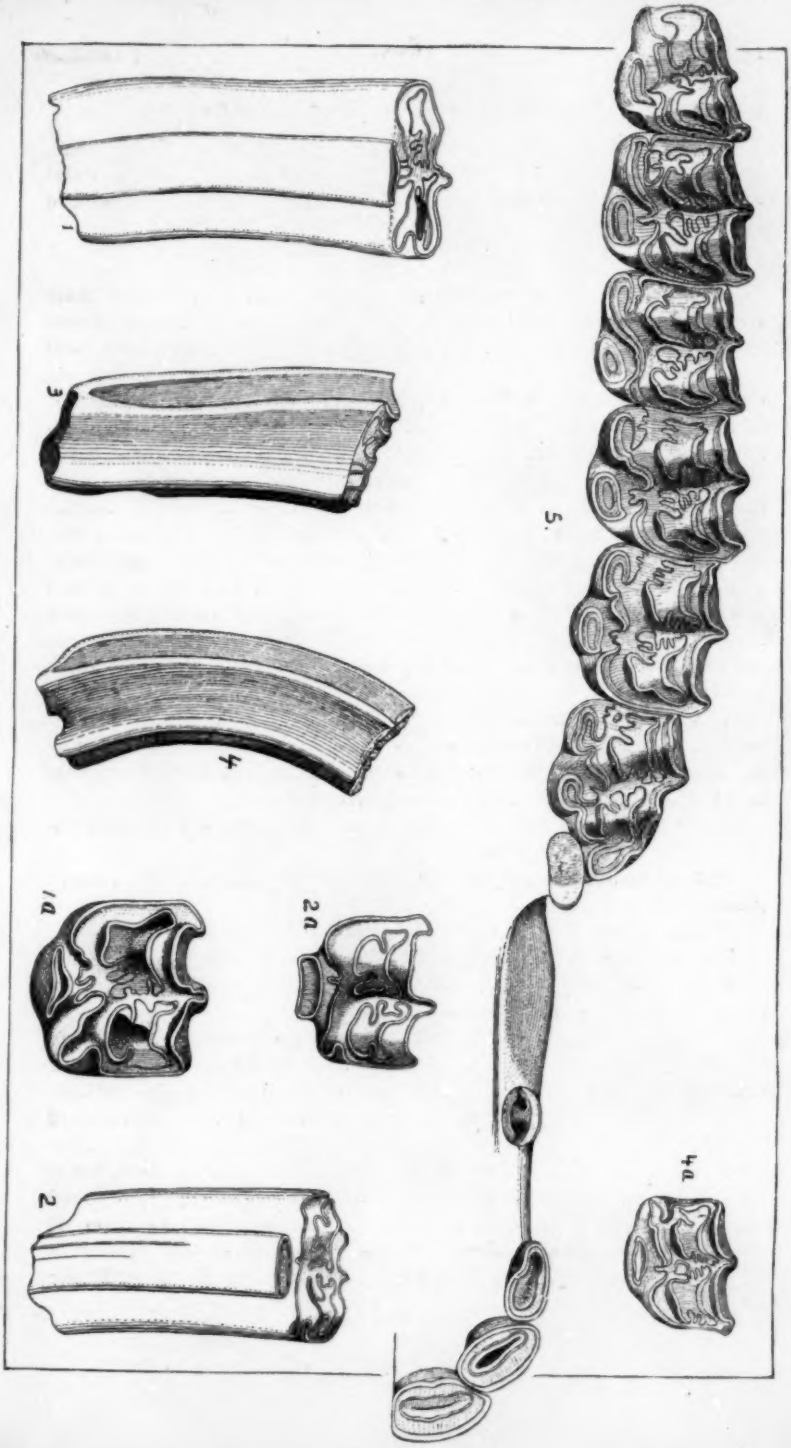
2. The house of Daumas-Béraud et Cie., of Paris, founded in 1865; employs eight whites and 100 blacks.

3. The Compagnie Portugaise du Zaïre which possesses half a dozen stations on the river.

4. Valle y Azevedo, Lisbon; four whites and thirty blacks.

All these houses own wharves and docks as well as sailing-vessels; the Dutch Co. owns four steamers; the French, and Hatton & Cookson Co. each one; the Congo Independent State, fifteen.

After leaving Banana, the stream narrows to five kilom., and is from 20 to 270 metres deep; the current is about five knots. After an hour Boulambemba point, locally known as *the bottomless pit*, is reached; twenty-two kilom. from Banana the "Scotchman's Head" is passed, and eleven kilom. further on, at Kissanga, are situated the Portuguese factories A short distance further, on the opposite bank, are the factories of Ponta da Lenha, established on the island of Tchiwangi. Here are found the bamboos used in building in great abundance; they cost from 50 to 75 francs per thousand. Even the very largest vessels can come up to this point, where begin the difficulties of navigation at the "Heron Bank."



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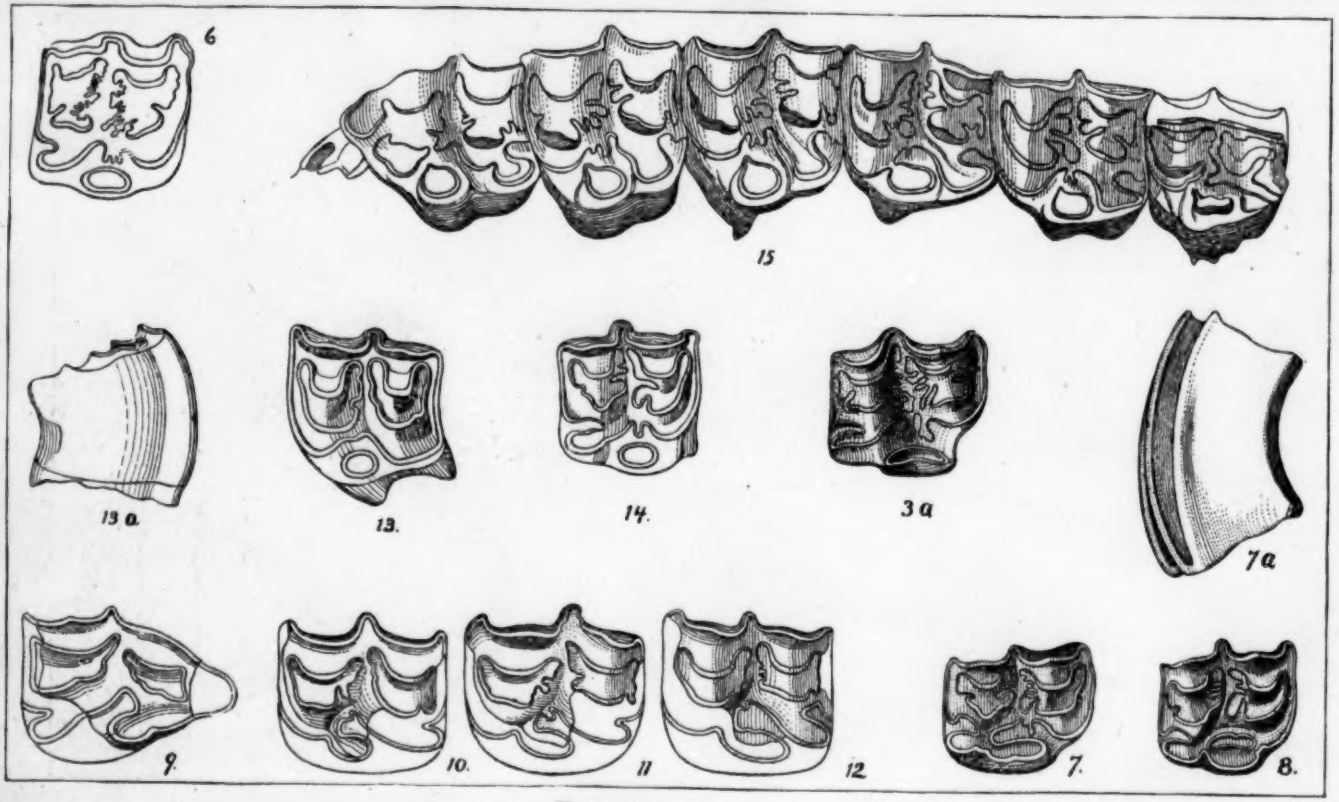

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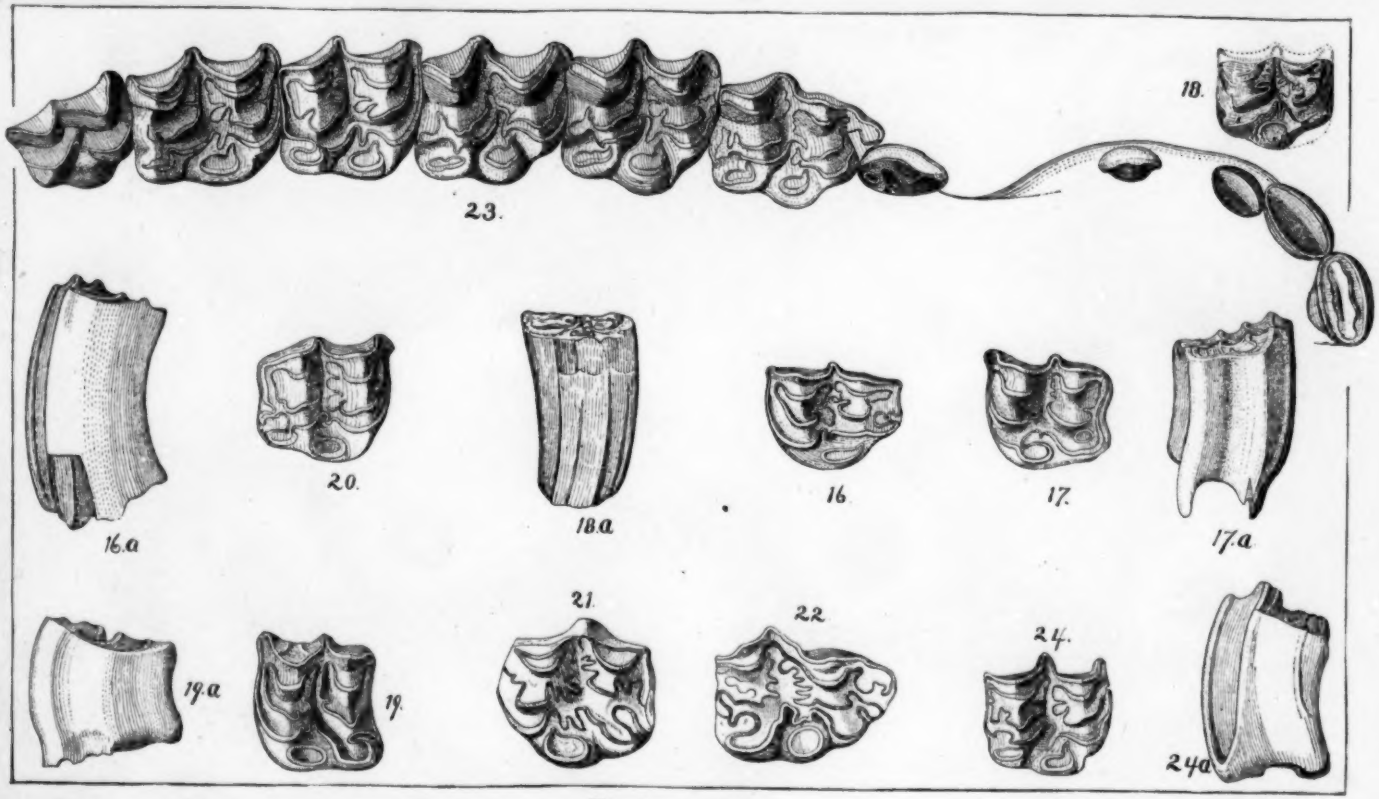

HIPPOTHERIUM.

From Ponta da Lenha to m'Boma the river contracts and is obstructed by several large islands.

At "Fetish Rock" the Congo storms over reefs and expands to 1500 metres in width.

At m'Boma the river is fifty metres deep, and is 4700 metres in width; here it is divided by islands into two arms.

m'BOMA

May be considered as the interior port, or, as a Belgian writer has well expressed it, as "the Antwerp of the Congo;" the tide here is only six or seven centimetres. Here is stored all the merchandise sent from Banana to be distributed in the interior, and here come the natives for traffic. It is at present the capital of the State and the centre of the commerce of the Lower Congo. The Dutch, English, French and Portuguese trading houses have large establishments here, employing about thirty whites and 600 blacks. A flourishing mission has been founded here by the Roman Catholic Church. In 1886 the Congo Independent State installed a postal service. It has also erected here an iron pier, well equipped with cranes for loading and unloading cargoes with the greatest facility. The government storehouses are connected with the wharves by a railroad. A Belgian commercial company, "les Magasins Généraux," is now building at m'Boma a huge hotel and spacious storehouses where all articles of consumption may be obtained at reasonable prices.

Passing up the stream, twenty kilom. after leaving m'Boma, the panorama changes, lofty and well-wooded mountains appearing on the right bank, while those on the left are barren and dry. Here terminates the alluvial basin. Above the large island, "Des Princes," the islets have disappeared, and the river shows only a vast expanse of tranquil water, from 500 to 2000 metres wide, whose banks reach sometimes to an elevation of 350 metres. The navigation becomes more difficult, owing to an augmentation in the strength of the current and the more frequent appearance of rock-reefs and rapids.

Seven hours' journey from m'Boma appears Noki, a Portuguese commercial centre and the last that belongs to that nation on the left bank of the Congo. Here is the frontier marked out by the Congress of Berlin; from this point both banks of the river belong to the Congo Independent State up to Manyanga, where the French possessions begin.

Along the river between m'Boma and Noki are about thirty factories, all substations of houses established at m'Boma.

Passing "Ango-Ango," "Fuka-Fuka" (where there are commercial houses), Underhill (where there is a Protestant mission), Matadi is reached. At this point begins land transportation for goods, etc. From here will start the railway line which is to connect the Lower Congo with Leopoldville, on the Stanley Pool.

Large ocean steamers can come to Matadi without breaking cargo.

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At Vivi, which is situated a little beyond Matadi on a plateau ninety-nine metres above the river, the navigation is stopped by the rapids. Further up the river begin the "Livingstone Falls."

TOPOGRAPHY.

The Congo Independent State is divided, topographically, into two regions, the one elevated, which is known as the Upper Congo, the other depressed, the Lower Congo. Between these territories rolls tempestuously the river Congo over thirty-two cataracts and rapids, forming an immense staircase that prevents all navigation for a space of 250 kilometres; it bars access to the most extensive, the most fertile and most healthy portion of the State.

To obviate this obstruction a railway has been planned that will avoid the cataracts and render communication more easy with the Upper Congo.

Lately the fertility and population of the Lower Congo have been called into question, on account of the marshy and desert stretches of country through which the lower river flows, but recent travelers state that this opinion is erroneous; that at a distance of about ten kilometres back from the river-banks there is a dense population, and that the region is fertile and cultivated.

CLIMATE.

The year on the Lower Congo is sharply divided into the hot season, or that of the rains, from the end of October until about the middle of May, and the dry season, from the middle of June to the end of September.

Day and night are of nearly equal length; toward 6 A.M. daybreak begins, and about 6 P.M. the evening twilight sets in, abruptly, without the intervening transitions usual in temperate regions.

The climate of Congo is, in comparison with that of most tropical countries, remarkably cool and agreeable. In the hot season the thermometer is seldom more than from 80° to 86° (Fahrenheit) in the shade, and in the "*cacimbo*," or cool season, it usually ranges from 60° during the night to 75° during the day. During the rainy season the markings are higher, and the humidity with which the atmosphere is filled renders the heat almost suffocating. During the dry season all day a refreshing sea breeze blows, frequently with considerable violence, which is replaced after nightfall by an equally strong one from the land, so the atmosphere undergoes a continual renovation, and a light covering is always desirable during the hours of darkness. The light rains occur in the lower country in October, succeeded by the great rains, with violent thunder storms.

Sooner or later the foreigner must pay his tribute to the climate in the shape of a spell of fever, although it can be readily checked by quinine before and after the attack. Careful and nutritious living, together with the avoidance of unnecessary exposure to the torrid heats of midday, and the heavy dews of night, are the best sanitary precautions. Spirits should be avoided.

The European regains by his appetite the strength that he loses by excessive perspiration; nothing but the extremest cleanliness can remove the epidermis that decays and replaces itself with enormous rapidity in this hot climate.* Continual baths and the wearing of proper clothing that will readily permit perspiration to take place with the utmost facility are indispensable.

RESOURCES OF THE CONGO INDEPENDENT STATE.

A. Mineral.

1. In the chain of mountains, towards the region of the cataracts, called, by the Portuguese, "*La Montagne de Cristal*," are found handsome pink and gray granite, red and rose-colored marbles, and especially remarkable white marble, beautifully veined with green. The quarries are easy to work, being in an easily accessible region, and close to the river.

2. Granites of all kinds are plentiful in the various parts of the Lower Congo, and the various limestones, necessary for building, etc., abound just where their presence is most desirable.

3. Two rich deposits of copper near the Congo, and indications of others pointing to a well-developed copper region, were found by Mr. Dupont whilst hunting for a reported deposit of malachite in the French Congo territory, to the north of the Valley of the Congo, in the province of Kwilu. These carbonates of copper contain usually from sixty to seventy per cent of pure copper.

4. Titaniferous sands were found, but no other indications of gold. Iron shows in abundance.

5. Iron, tin, lead and sulphur show in abundance.

B. Agricultural.

Whilst the Lower Congo is marked by rocks and arid plains, the traveler is struck, when ascending the river, by the vivid aspect of the luxuriant trees, herbage and vegetation in general, and the wide plains whose agricultural fertility and values seem enormous. A deep, black soil is found, of considerable extent, whose cultivation has resulted in large returns. The deforesting of some parts of the Congo was studied by Mr. Dupont, who is of the opinion that, by a judicious use of the rivers between the Stanley Pool and the Congo, all the devastations and ravages can be repaired, and the best results ensue.

Manioc is abundantly cultivated. 20,000 kilos. to the hectare result in six months, even with a *vicious* system of cultivation.

Palm nuts are found in profusion, in bunches that often number 500 to the cluster. A palm-tree will bear annually a score of such clus-

* The writers who growl at the supposed impoverishing nature of the food attainable in Central Africa are thus characterized by Bateman: "*Their only ground of plausible excuse being the impossibility of glutting themselves with vulgar masses of British beef, stodgy potatoes, and bile-creating beer.*"

ters, representing in the markets of Europe a value of from twenty-five to thirty francs. The production is 24,000,000 kilos., and can be indefinitely increased. The oil is expressed and barreled in casks of 500 litres capacity, in which form it is transmitted to Europe. The fruit is eatable, and, when cooked, tastes like the *scorzonera;* raw, it makes a very good salad. From the fibres of the palm are woven dress-stuffs, mats, hats, baskets, nets, etc.

The *arachid* is a species of ground nut, largely cultivated by the natives, and used in the preparation of culinary delicacies. A fine oil is expressed from it, which, in commerce, passes for olive-oil. At present the almond-palm, palm-oil and arachid constitute seventy-five per cent of the exports of the Congo.

Caout-chouc is very abundant. The gum is brought by the natives in black or white balls, the former looking like Perigord truffles; the latter, however, are the more esteemed. It grows luxuriantly and spontaneously.

Trees; the *Baobab* is found on the coast from Ponta da Lenha, and reaches colossal proportions, often measuring about twenty-two metres in circumference. One at Landana can scarcely be encompassed by seventeen persons forming a circle around with outstretched arms, hand in hand.

The *Kolla* is a lofty tree, of frequent occurrence; it bears a rounded fruit the size of a small melon, from which caffeine is extracted.

Colored woods abound, red, brown, yellow, all susceptible of easy manipulation; the *tavoula* (a red wood) is especially in demand; at least a dozen tons of woods are annually exported from Banana (1886).

The Cottonwood tree often attains a height of over 200 feet; the Kusu-Kusu, the Redwood, the Camwood, the Teak, Acacia, Ebony, Arbor-vitæ, Saffu, abound.

Fruit Trees: banana, mango (each of which latter trees furnishes, yearly, 400 kilos. of fruit, from which an alcoholic beverage of very fine quality is extracted), the papayer, the maracouja, the lemon, mèagang (or yellow grape), pineapple, exist in enormous profusion.

Copal exists in quantities as yet undetermined.

Cotton grows wild in the Lower Congo, and all the conditions favorable to its fullest development exist. The specimens already obtained are said to warrant the belief that it can equal the usual American article.

Tobacco is cultivated throughout all Africa, but of varying qualities. It has a good taste and an exquisite aroma.

Pepper (called by the natives, pépé or pili-pili) is abundant; its fruit is red: it is both large and small.

Sugar Cane has only once been cultivated, and the experiments are not complete; abandoned in one place, in 1886 plantations have been formed in another on a very large scale.

Vegetables. The onion, alone, of all European vegetables, does not seem to thrive; salads, radishes, peas, carrots, turnips, string-beans, cabbage, parsley, tomatoes, cucumbers, celery, potatoes, all grow well.

Cuttings and slips from Madeira vines have been planted with great promise.

Maize, coffee, sesame, orchal and sorghum grow plentifully.

The inhabitants are willing to work, and both male and female are to be seen in the fields.

Animals.

Elephants are seldom seen unless a famine drives them towards lower feeding grounds. They are, however, sometimes found. Ivory is an important product exported to the London market. The buffalo, leopard, antelope, wild cat, wild boar, goat and dog abound. The hippopotamus and rhinoceros multiply in the Congo and its affluents; myriads of apes people the forests. The eagle, the hawk and the vulture are the chief birds of prey, and the duck, goose, pigeon, chicken, the turtle dove, the bengalee, the grallœ, the cardinal, green parrakeet and gray parrakeet with red tail, and kingfisher are found plentifully.

Snakes of the python variety exist in vast numbers.

Cattle.

Fine herds of cattle are grazing on the Island of Matebba, situated half way between Ponta da Lenha and Boma, where M. de Roubaix of Antwerp has an important farming enterprise. Several hundreds of heads of cattle are kept also by the State at Boma for the consumption of its numerous "personnel." Private commercial houses, as Mess. Valle y Azevado, possess large quantities of live stock.

In 1888 commercial value of goods handled at the Congo Independent State was 14,000,000 francs, of which 7,500,000 was exports.

ARTICLES OF IMPORTATION.

In exchange for ivory, palm nuts, palm oil, arachides, caout-chouc, dye-woods, copal, etc., brought by caravans to the various factories, the natives receive flintlock and percussion guns, flints, powder, cotton goods, rum, pearls, copper rings, table and pocket knives, old clothes, straw and felt hats, cotton and flannel shirts, glass and pottery ware, umbrellas, wooden and iron coffers, locks, chains, tin forks, tin cups, big and little bells, razors, scissors, combs, perfumery, soaps, mirrors, needles, pins and thread, buttons, white ribbands, gardening tools, matches, clay pipes, bracelets, ear and finger rings, copper bands for arms and legs, musical boxes and accordeons, etc., etc.

COMMUNICATION WITH EUROPE.

1. A monthly line from Liverpool (The African Steam Navigation Co.), taking about forty to fifty days; fare, 700 to 800 francs.

2. The Woerman Line, from Hamburg, at the end of every month. Time, forty-five to fifty days; fare, 750 francs.

3. L'Empreza National, from Lisbon, on the sixth of the month; twenty-two days; 750 francs.

4. Nieuwe Afrik. Handels-Vennootschap, Rotterdam, five times a year; twenty-one to twenty-two days.

5. Hatton, Cookson and Co.'s steamers, from Liverpool.

RAILROAD, &c., IN THE CONGO INDEPENDENT STATE.

As above stated, a railroad is to go from Matadi to Noolo, near Leopoldville, on Stanley-Pool, for which the survey, employing fourteen engineers for sixteen months, has just been completed and estimates prepared. Its cost has been estimated at 25 millions of francs, including purchase of rolling stock and miscellaneous expenses in Europe and Africa, and is considered sufficient to pay besides the expenses an interest of 7% during the four years that are deemed necessary for the laying of the road.

The length of the line will be 436 kilometres, of which only the first twenty-six present any engineering difficulties, while the remainder of the line "will be laid under exceptionally easy circumstances." It will have a rail gauge of 75 centimetres, with steel rails weighing 23 kilos., steel sleepers at equal distances of 80 centimetres and weighing 23 kilos., the whole of the line weighing 75 tons per kilometre.

The neighborhood through which the line is to pass abounds with ample materials for ballast, and firm soil is found for the abutments of bridges very near to the surface of the ground.

Matadi, the starting point of the railway on the Lower Congo, is a place easily accessible to sea-going vessels, and where they can discharge their cargoes directly into the freight cars; Noolo, the terminus at Stanley-Pool, is a short distance above Kinchassa and 3 miles from Leopoldville, well above all the rapids that obstruct and hinder navigation in the region of the Cataracts. From this point light draught vessels can ascend the Congo and its affluents for an uninterrupted distance of eleven thousand five hundred kilometres. Large docks can be advantageously built at Noolo. Between these two first-class stations an intermediate one will be placed at Kimpésé, where travelers will spend the evening, as it is not intended to run any trains during the night, and the distance is too great to be traversed within one day. Stations will also be established at Loufou, Inkessi, and Ntampa, thus dividing the whole distance between the Lower Congo and Stanley-Pool into five sections of an average length of 85 kilometres each.

The journey that now requires a whole month for its accomplishment, entailing delay and often damage, could then be made within two days, and the expense of freightage greatly reduced, enabling goods to be delivered in Europe at a much greater profit.

The navigable waters of the Upper Congo are 6000 kilos. Steamers

can go from Leopoldville almost to the Soudan, by the "Oubangi-Ouelle."

POLITICAL, JUDICIAL AND ADMINISTRATIVE ORGANIZATION.

The King is the absolute monarch, ruling without any check to or division of his power.

A decree of King Leopold, dated October 30, 1885, organized the Congo Independent State into three departments, *viz.:* Foreign Affairs (to which is entrusted that of Justice), Finance and the Interior. An Administrator-General, named by the sovereign, presides over each of these departments, who deliberate together over the affairs of the State, and submit the results of their councils to the King for his approbation. The departments have jurisdiction as follows:

A. Foreign Affairs, which includes commerce, post-office, justice, legislation, religion, etc., etc.

B. Finances:

(*a.*) All manner of taxes, duties and imposts; all regulations of territory.

(*b.*) The general department of accounts and all matters relating to the operations of the treasury.

(*c.*) The monetary system.

C. Department of the Interior:

Public instruction, police, hygiene, transportation in all its phases, public roads, public armaments, etc., etc.,

The Governor-General of Congo rules under the directions of this Central Council, assisted by an Inspector of State, a Secretary-General, and many subordinate local assistants.

The territory is divided into eleven districts, administered by a Commission, with one or more adjuncts. The districts are Banana, Boma, Matadi, Cataracts, Stanley-Pool, Kassai, Equator, Ubangi-Uellé, Aruwimi-Uellé, Stanley Falls and Luluaba.

LAW DEPARTMENT.

Justice is administered by a tribunal of the first instance, and one of appeal.

The Appellate Court has its permanent seat at Boma; the lower Court, whose place is at Banana, may travel within its district, the Lower Congo, up to Vivi and Matadi.

Other tribunals have been erected at Leopoldville and Lukungu.

The death penalty is abolished, except in the case of cold-blooded, deliberate murder, and voluntary homicide is punished by imprisonment for life.

THE CIVIL STATE.

There are offices at Banana, Boma and Leopoldville, where are registered the births, deaths and marriages occurring among the European population. Marriage must be preauthorized by the Governor-General, and the ceremony performed by an official to be designated by him. The rights and duties arising from matrimony are governed by the laws of Belgium. Arrivals, departures and changes of domicile are registered at Banana and Boma.

LAND-HOLDINGS.

When, in July, 1885, the sovereignty of the Independent State was proclaimed at Banana, at the same time a decree was published that no one should attempt to dispossess the natives from any of their lands, and that further, no territorial contract with them should be valid unless made through an authorized agent.

On August 22, 1885, another decree invited all foreign-born inhabitants, who claimed land-rights in the dominion of the Congo Independent State, to declare them before the proper official conservator of titles, so that they could be entered in the registry, and the State could create and confirm a valid and legal title to each proprietor. By this measure considerable confusion and litigation were put an end to, for the blacks had often sold the same property several times over to a different purchaser.

A system, analogous to the "American Land Patent System," was created, and an alienation was to be accomplished, by registry at a record office, the fee for which was twenty-five francs at each enrollment.

For the purposes of sale the State divided all lands into two classes: 1. Those belonging to the aborigines, and unoccupied lands. 2. Those the property of the State itself. Any and all transfers of land in the first category must imperatively receive the approval of the Governor-General before they could be held valid. The lands of the second division were sold only upon spontaneous demand, the contracts being signed by "The Conservator of Titles," and approved of by the Governor-General. If the property in question exceed 100 hectares, or embrace 200 métres of riparian rights, the contract of sale must first be sent to Bruxelles for the approbation of the central government.

These regulations are only carried out strictly in reference to the Lower Congo region; on the Upper Congo the acquisition of territory by Europeans is to be encouraged, and they are to be permitted, without preauthorization, to acquire any unoccupied land not exceeding ten hectares, and not extending more than 200 métres along the Congo or other navigable water-course, always providing this can be done peaceably and without detriment to other rights. To occupy more land than the amount above given the consent of the government must be obtained. So well was the project carried out that, in less than three years from the date of

the proclamation by the State, the registration of every non-indigenous land-holder was completed, not without much arduous labor.

Matters relating to mines and forests are under the control of the same department that regulates lands. Except on one's own legally registered property no trees nor plantations can be cut or damaged, unless with the consent of the Governor-General or one of his authorized deputies, previously and specially obtained. No mines can be worked without a license from the sovereign, and the sale and transfer of lands by the State does not confer any mineral rights.

RELIGIOUS MISSIONS.

By the sixth article of the Berlin Conference, all the signatory powers engaged to watch over the preservation of the indigenous populations of that region and to ameliorate their moral and material conditions of existence, and guaranteed an especial protection to missionaries, savants and explorers. Liberty of conscience and religious toleration were expressly guaranteed both to the natives and to European settlers without any restriction whatever.

The care of the missionaries is an astute idea; they are always the precursors of civilization, undergoing hardships, in their spiritual zeal, from which ofttimes men shrink who have no loftier motive than love of wealth. Every mission founded is a central source from whence the influence of white culture sheds, beacon-like, a far-reaching influence among the less famed nations of the world and becomes one more step towards their peaceable conquest by civilization. By them the points of contact are increased, and through them relations of the most friendly character are established and maintained. To their schools resort the young barbarians, desirous of becoming acquainted with the wonder-working arts of the European, and they return not only with a knowledge of rudimentary education, but also with ideas as to how to obtain the most profit from their badly tilled fields, and once again the lamp of science is handed on yet one step further in its dissemination.

The missionaries of Christendom are the barrier to the progress of Islam in the dark continent, an influence that can hardly be overestimated. "Wherever Islam penetrates," writes Dr. Nachtigall, "slavery is installed, and to demolish the traffic in human beings, it is necessary to strike at its source, in Islam."

No traces are to be found of the good results formerly accomplished by the labors of the zealous workers of the sixteenth and seventeenth centuries; indeed, by the eighteenth century, the indigenous races had totally relapsed into a brutal and beastly idolatry. A few isolated attempts were made to remove this sad state of affairs, but without great success. When, in 1885, the Congo Independent State was founded, two missions were existing on the Congo; the *Pères du Saint-Esprit* were installed at Boma and some Protestant missionaries were at Stanley pool.

At present *La Congrégation de Scheutveld*, that has attained a remarkable success in Asia, has taken the evangelization of the Congo under its charge, and the Holy Father, in a late brief by which a vicariat was created, has confided to them the noble project. A mission has been established at the junction of the Kassaï and the Congo, where schools have been established, not only for spiritual and scientific instruction, but also where the knowledge of manual labor of all kinds is imparted.

Flourishing Roman Catholic missions exist at Banana and at Boma; the Protestants are along the river as far as the Station of the Equator; some religious establishments of the *Pères d'Alger* are on the west bank of Lake *Tanganyika*.

On December 31, 1888, a society was founded under the title of "L' Association Congolaise et Africaine de la Croix Rouge," whose object was to render service to the sick and wounded in time of war, and at all times to give aid and assistance throughout the extent of Africa to all who, in the interests of civilization in Africa, have become ill or injured, as well as to those of the natives who might be suffering. The Society will be represented in the Congo by the Governor-General.

FINANCES.

The monetary system is based upon a gold standard. The currency

5 Centimes.

1 Centime.

10 Centimes.

consists of francs and centimes; the franc representing the 3100th part of a kilogramme of gold nine-tenths ($\frac{9}{10}$) fine.

The gold coinage consists of twenty-franc pieces; the silver of 5, 2, 1 and ½ franc; copper, 10, 5, 2 and 1 centime.*

The gold and silver coins are manufactured in conformity with the regulations of the Latin Monetary Union, and are the finest specimens of coinage of the present generation.

PUBLIC DEBT.

By edict of February 7, 1888, the public debt is to be 150,000,000 francs, divided into 1,500,000 obligations of 100 francs each, in 60,000 series of twenty-five each, bearing interest at five per cent.

The debt has ninety-nine years to run, and six times a year a certain number of bonds are redeemed.

In the first eight years premiums are drawn for 1,000,000 of francs; in the second for 700,000; and in the next for 512,000 francs. In the last seventy-five years the drawings will amount to 270,000 francs.

A sinking fund is created for the redemption of the debt as it becomes due.

On February 14, 1888, 10,000,000 francs were issued, in bonds of 100 francs each. On the 7th of May last (1889), a second issue of 60,000,000 francs of the same bonds has taken place.

The annual revenue derived from the State was (in 1886) 1,700,000 francs, which more than defrayed all expenses.

AUTHORITIES CONSULTED.

Bulletin officiel de l'Etat Indépendant du Congo. Années 1885 à 1889.

Chemin de fer du Congo; par A. J. Wauters. Bruxelles, 1887.

Conférences de la Société Belge des Ingenieurs et Industriels des 20 et 27 Janvier, 1886, et des 17 et 24 Février, et des 10 et 17 Mars, 1886. Bruxelles, 1886.

Code Civil de l'Etat Indépendant du Congo. Bruxelles, 1888.

Code Pénal de l'Etat Indépendant du Congo. Bruxelles, 1888.

Droits de Sortie de l'Etat Indépendant du Congo; règlement de perception. Bruxelles, 1886.

Etude sur la législation de l'Etat Indépendant du Congo, par G. van Moorsel. Bruxelles, 1887.

Leopold II, Roi des Belges, chef de l'Etat Indépendant du Congo * * * par Gustave Oppelt. Bruxelles, 1885.

Memorial Diplomatique. Tome xxv, Nos. 25, 28, 29, 30, 32, 33, 35. Paris, 1888.

Notice sur l'Etat Indépendant du Congo, par H. Droogmans. Bruxelles, 1888.

Part de la Belgique dans le mouvement Africain. (s. l., s. a., ca. 1887.)

* The writer has deposited in the U. S. National Museum, Washington, D. C., a complete series of the silver and copper coinage.

Report of the Secretary of State and correspondence in relation to the affairs of the Independent State of the Congo. Washington, 1886.

Rapport du Comité d'Etudes sur la question du Congo (Société Belge des Ingénieurs, etc.). Bruxelles, 1886.

Rapport de la Commission Administrative de la Société Belge des Ingénieurs, etc., à l'assemblée générale sur la question du Congo. Bruxelles, 1886.

Résultats de l'Exploration scientifique faite au Congo, par M. Edouard Dupont en Juillet—Décembre, 1887. Bruxelles, 1888.

Résultats géologiques de l'exploration de l'Etat Indépendant du Congo, par M. Edouard Dupont. Bruxelles, 1888.

Système monétaire (Département des Finances de l'Etat Indépendant du Congo). Bruxelles, 1887.

Trafic des Spiritueux dans le Haut Congo. (Département des Finances, etc.) Bruxelles, 1887.

United States Consular Reports. No. 54, July, 1885; No. 56, August, 1885. Washington, 1885.

The First Ascent of the Kassaï, * * by C. S. L. Bateman. London, 1889.

L' Association Congolaise et Africaine de la Croix Rouge par un de ses membres. Bruxelles, 1889.

The Congo Railway * * * Brussells, 1889.

Some Thoughts on the Sun and Cross Symbols.

By Richard Vaux.

(*Read before the American Philosophical Society, May 17, 1889.*)

Symbols were the characters of original language. The alphabets of all written languages are composed of signs.

To express a thought, a form was necessary. To think was a human faculty. It marked man as the highest type of created beings. A thought was the result of an impression on the mind, made from a sense, or by sensation, through some object, or a consequent corelative emanation.

To find a form that would embody the mind's impression was solved in a sign, or symbol. The mental, or reasoning process, by which this result was reached is not possible of explanation. We know that the senses conveyed to the mind a cognizable impression, and then the mind operated. This process is called reasoning.

The sign was made to represent an impression on the consciousness. This sign, or symbol, is either the impression produced by natural objects, or it is an expression of a revelation, crystallized on that impression.

It is believed that the primitive types of the white race, as far as is now known, had a sign language.

The need of a form of expression was inherent, implanted in man at the creation. To communicate or impart the thought was as essential as to live. The form of such expression was the actual primary exclusive mode adopted by force of a like necessity. The symbol was the only possible form. If the symbol was the interpretation of the comprehension of the natural object, that was the revelation taking form, and the symbol formulated the revelation. If the symbol was accepted as presented, and interpreted by others, it strengthens the contention of a revelation to those who presented it. The origin of the symbol and its diffusion among other peoples who adopted it, proves that the revelation was a supernatural endowment of the human race. If the symbol expressed a mental impression which existed consciously, its form reflected what was inherent in the mind. If that symbol was found among different peoples, and expressed among all who originated, or adopted it as the same inherent expression, it became a language. A tribe on a continent, and one on another, using the same symbols, may give force to the suggestion that they were received by intercommunication, but the psychological condition of each must have been equivalent to produce the symbol, and the adoption of it under the same or a similar interpretation.

The important question remains as to the derivation of the activity and receptivity of the consciousness of these peoples.

Their physical conditions may have been alike; the natural surroundings somewhat similar; but they do not account for their inherent equivalent consciousness, unless it comes from a superhuman revelation.

As far as we know, there never has been an *invented* symbol.

Revelation begins in the thought, or in the adaptation of the symbol as a measure of the revelation anterior or posterior to its adoption.

As growth strengthened, the mental powers felt its influence, and consciousness, and the receptive faculties became sensitive. The ability to compare different conditions led to conclusions, and this was the demonstration of the reasoning faculty. Natural objects, the observation of natural changes, became subjects for thought.

The comprehension was stimulated by these observations. The nutritive and sensitive, which were material conditions, gave place to the rational, which was spiritual. The mind began to appreciate that a cause existed. That it was not of human origin was evident. Then, it must be supernatural. The cause, whatever it might be, was beyond the range of man's power, or knowledge. It was not an accident possible to human mental acquirement. The sun rose, and set. Man could not control, order, or decree its positions. Some supernatural power was the cause. Then, the sun was a supernatural existing power. To decide what it was exhausted the capabilities of the mind of man. The comprehension of the fact left no alternative but to call it a God. This was a spiritual revelation. The mental and the spiritual comprehension were in accord.

The sun was that supernatural power which was accepted as governing man. The circle became the symbol. These were revelations. Man was created; the sun was created.

These facts are undeniable. Sun worship is a fact associated with the primal condition of the existence of primitive man.

Science must accept these facts, however it may deal with them. It is also a fact that various peoples, in the earliest of days, accepted the sun as a supernatural manifestation, and the circle was its symbol. If philosophy is the love of wisdom, or the explanation of the reason of things, yet it cannot demonstrate why the sun was first worshiped. Therefore, the truest explanation is that this natural object, impressing the mind of the beholder, drew out of the inherent spiritual consciousness the only thought possible, a revelation of a Creator, superhuman, self-existing, with power and majesty.

With all our philosophic knowledge, it must be admitted that this explanation is so natural as to be neither a speculative, nor a mythical theory.

To give authoritative force to this explanation, the universality of sun worship in the earliest days must be shown. From the best authorities, sun worship may be said "*to have been universal among nations the most remote from each other, from the Torrid to the Frigid Zone. It spread over America, as it did over Europe, Africa and Asia.*"

"*All ancient religions when analyzed prove to be only forms of solar worship.*"

"*Thus we find the early nations of all parts of the world claiming a solar origin.*"

From the same authorities, it may be said that this is true of the Scandinavians, Egyptians, Phœnicians, Assyrians, Indians, Greeks, Romans, Mexicans, Peruvians, Persians, Medians and Arabs.

Yet it is to be observed: "*That contests between the spiritual and material nature of man are found in the earliest antiquity.*

"*In Europe and Asia the people had a simple faith in the powers of nature, the most notable of which was that Great Luminary, the Sun, which throughout all ages, and amongst nations, under one name or another, has been universally the object of adoration.*"

"*We search into emblems with a different intention to that which we inquire into ordinary language. The last tells us of the relationship of nations upon earth; the first of the probable connections of man with Heaven. Letters and words mark the ordinary current of man's thoughts, while religious symbols mark the nature of his religious aspirations.*"

How the universality of this worship came to pass cannot be accounted for by the intercommunication of peoples. It therefore, with confidence, is pointed out, that it is a revelation.

This revelation is the outcome of the primal inherent consciousness of man, under the influence of the material and nutritive, sensitive and rational elements of his being.

It is pointed out that the sun symbol is as universal as sun worship. It is the same symbol among peoples. The circle with rays, and with a centre point, is the expression of both the natural and spiritual consciousness. As Divine, Superhuman, a Creator, the Origin of Life, the symbol took the form of the sun itself, and the primitive man was taught by a revelation, the theology to which the symbol was dedicated. What more reasonable than that the figure of the sun should be the figure of the worship? Whatever may have been added to this symbol in after-time by the ingenuity of scientific hypotheticism, the fact remains that the sun symbol originated in the revealed conception of a purely religious significant truth.

We think this is the consensus of authoritative opinion of many students and scholars. To cite them is to catalogue the exegetical treatises from Moses to Mühler. It is at least permissible to add that the sign on the cloud and the darkness at Calvary were symbolic evidence of a supernatural revelation.

One more example compels notice.

The Cross.

Christianity may be called the equator that divides the ante- and post-Christian eras. In both, the Cross has been a religious symbol. In the very earliest religious systems there was a more or less imperfect recognition of one Supreme Being, the origin of created beings, even the gods themselves. This is found among the Scandinavians, the Hindoos, the Teutonic and Aryan races. The Great Spirit was recognized among all the Indian tribes. The circle with the central point is one of the earliest symbols of the Great Spirit from which the Hindoos taught all things proceeded.

The date of the origin of this symbol is not known. It may have been prior to the interlaced triangles of the Hindoos. Its history, however, shows that from the beginning it was exclusively of religious import. With the sun worship, it was universal among primitive peoples. It was a symbol, and it is said it is never found except to express some religious idea.

"When we see the same ideas promulgated as Divine truth on the ancient banks of the Ganges, and the modern shores of the Mediterranean, we are constrained to admit they have something common in their source. They may be the result of celestial revelation, or they may alike emanate from human ingenuity. Religious symbols mark the nature of man's religious aspirations."

When the Cross became a symbol cannot be determined. It can successfully be asserted that among primitive peoples it held a conspicuous place, with a spiritual and mystic significance.

The Circle symbol identified with sun worship, crossed, added to its sacred character. In very remote antiquity, many centuries before our era, the crossed Circle was a religious symbol.

Prehistoric and pagan traditions show that in man a spiritual consciousness existed.

Aristotle, in his subdivision of the Nutrient, the Sensitive, and the Intelligent or Rational, as indicating the growth from the material to the spiritual, portrays the highest form of this growth to be religious thought. It may be from the different effects of the senses and sensations arising out of the four causes,—the body, represented by the material; the soul, comprising the formal; movent, or efficient, and the final, or spiritual.

This philosophy of growth is the explanation of the relation between what is the mental, moral, and physical trinity in our nature. In the earliest days in the life of man this spiritual faculty existed. The fact that symbols were then known, and that they emanated from this spiritual faculty, sustains the contention that a religion was a revelation to every people, and that under some form a supernatural Divine Power was worshiped. The Circle symbol of the Sun God, to which a cross was added, must be regarded as significant of the primitive principle of this worship. A Cross appears among all the peoples of whom any knowledge is obtainable from traditions.

The Crux Ansata, or the Cross of Horus, or Tau, fifteen centuries before our era, the Cross Cramponne, the Thor's Hammer, Fylfot, Croix Patte, the Swastika, the Maltese Cross, the Handled Cross, are associated with worship as a symbol. The hieroglyphics in the Temple of Serapis indicate that the Cross there is interpreted, "Life to come." The Maltese Cross was found in the ruins of Nineveh, another in the Hall of Nisroch. The Handled Cross was a sacred symbol among the Babylonians.

The authorities consulted justify the contention that the Cross in its various forms was a spiritual symbol of religion. In Europe a people is reported to have lived more than fifteen hundred years before our era, of whom nothing is now known. Quarries are found, called *terramares*, on the site of the locality of these people, and the researches in these quarries showed that the Cross was a religious symbol among them. The tombs of Golasecca show the fact that one thousand years before our era the Cross was a like symbol. In a ruined city in South America, not inhabited at the time of the conquest, a palace has been discovered, and in it a slab of gypsum on which a sculptured Cross was found. And also another colossal Cross represents on it a bleeding deity, with a Tau Cross, surrounded by figures. The city existed nine hundred years before our era. The palace in Palenque was 128 feet long, 180 wide, and 40 high, in which are temples, chapels and altars. The same Cross is found in pre-Mexican writings, as in the Dresden Codex.

In Mexico, Paraguay, Peru, among the Maya race in Central America, and the Azteks, Quinamies, Zapatecas, and the inhabitants of the ruined cities of Zaputero and St. Ulloa, the Cross was venerated as a sacred symbol.

It has been said by high authority, that:

"The widely spread mystic purport of the Cross Symbol has long been a matter of comment. Undoubtedly, in many parts of America, the natives regarded it with reverence anterior to the arrival of Europeans; in the old world it was long a sacred symbol before it became the distinctive Emblem of Christianity."

It is pointed out that during the historic period, till our era, no evidence asserts a denial of this fact. All the mythologies, Scandinavian, Egyptian, Assyrian, Greek and Roman, the tombs, temples, obelisks and pyramids contain cumulative evidence of this characteristic of these symbols. Some of the esoteric symbolisms of these mythologies permeate the teachings imparted to-day to five hundred thousand men in the United States. It is also contended that out of the spiritual consciousness of all peoples came a religion as a fact. That it was a revelation is as well worthy of credence as that it originated in the ingenuity of material speculation. As before suggested, the use to which these symbols may have been applied, and with which theories and scientific hypothetical inventions have in late times sought to associate them, fails, nevertheless, to destroy their original character. The Phallic theory has no claim on science or philosophy. It portrays the sensuous and the erotic. The scientific effort to divert the primary relations of these symbols from the assertion of the spiritual consciousness of man is ingenious and attractive, but its force is in the weakness manifested to make this effort successful.

It is most reasonable that with the very limited knowledge of primitive man, natural objects were looked upon as the exclusive causation of sensations. Perceptions and impressions were thus derived. The consciousness accepted the object as the material, and the formal, movent or efficient, and final were spiritual.

The spiritual consciousness absorbed this impression of the nutritive and sensitive consciousness. It then came to pass that the Sun, the Serpent, and the Tree became symbols of worship, as the natural consequences of a revelation of a spiritual aspiration, and the worship of these symbols is therefore the test of a Divine revelation as the only possible explanation.

The conclusion that synthetically follows this line of thought on the facts given, from authorities alike credible and acknowledged, is that symbols expressed the sensitive and spiritual conscious impressions and aspirations of people since the creation of man. These symbols were the concrete revelations of a Deity to the human race as a Superhuman Divine Power.

Science, a superrarified philosophy, and modern speculation cannot divest them of their primary character. Revelation imparted to man this primal purpose and significance of these symbols. They rest neither on speculative assertion nor ingenious assumption; but were rather the emanation of a Divine ever-existing power.

PROC. AMER. PHILOS. SOC. XXVI. 130. 3I. PRINTED OCT. 25, 1889.

Stated Meeting, September 6, 1889.

Present, 2 members.

Dr. HORN in the Chair.

Correspondence was submitted as follows: Letters accepting membership from Andrew A. Blair (May 21, 1889), Henry D. Gregory (May 20, 1889), Philadelphia; Lester F. Ward (June 1, 1889), Washington, D. C.; Paul Hunfalvy (May 10, 1889), Buda-Pesth.

Circular from Royal Society, New South Wales, announcing premiums for 1889, 1890 and 1891.

Circular from Gen. C. W. Darling, Utica, N. Y., in reference to a projected work on "The more Important Versions of the Bible."

Circular from Dr. R. H. Lamborn, New York City, N. Y., in reference to the destruction of mosquitoes and houseflies by artificial propagation of the dragon fly.

Circular from Rothery, Davis & Co., Philadelphia, offering for sale a collection of antique pottery.

Letter from Prof. Steiner, Darmstadt, in reference to Pasilengua and the proposed Congress to be called by the American Philosophical Society.

A letter from the Anthropological Society, Washington, requesting exchanges, which was so ordered.

A letter from the President of the Society reporting the appointment of Dr. Hays to prepare the obituary notice of Dr. Gross, and enclosing his acceptance of the same.

A letter from Mr. Robert Patterson in reference to the obituary notice of Franklin Peale, read by himself before the Society, December 16, 1870 (Proceedings, xi, 597).

Letters of envoy were received from the Institut Egyptien, Cairo, Egypt; Mining Department, Melbourne, Victoria; Royal Society of New South Wales, Sydney, N. S. W.; Survey of India, Calcutta, India; Observatoire Physique Central, St. Petersburg, Russia; Naturforschende Verein, Brünn,

Austria; K. B. Gesellschaft der Wissenschaften, Prag, Bohemia; K. P. Meteorologische Institut, Berlin, Prussia; Verein für Chemnitzer Geschichte, Chemnitz, Saxony; K. Leopoldinisch-Carolinische Akademie, Halle a.S., Prussia; Vogtländische Alterthumsforschende Verein, Hohenleuben, Saxony; Physikalisch-Medicinische Societät, Erlangen, Bavaria; K. Sächsische Gesellschaft der Wissenschaften, Leipzig, Saxony; Gesellschaft zur Beförderung der Gesammten Naturwissenschaften, Marburg, Prussia; Société de Physique et d'Histoire Naturelle, Geneva, Switzerland; Académie R. des Sciences, Amsterdam, Netherlands; Fondation de P. Teyler van der Hulst, Harlem, Holland; Académie Royale des Sciences, etc., de Belgique, Bruxelles, Belgique; Musée Guimet, Ecole Polytechnique, Paris, France; Royal Statistical Society, Meteorological Office, London, Eng.; Radcliffe Observatory, Oxford, Eng.; Museum of Comparative Zoölogy, Cambridge, Mass.; Prof. Edward North, Clinton, N. Y.; Observatorio Nacional Argentino, Cordoba, S. A.

Letters of acknowledgment were received from the New Zealand Institute, Wellington, N. Zeal. (128); South African Philosophical Society, Cape Town (126, 127); Imperial Academy, Physical Central Observatory, Prof. Serge Nikitin, St. Petersburg, Russia (128); Tashkent Observatory, Tashkent, Russia (128); Prof. Paul Hunfalvy, Buda-Pesth, Hungary (127, 128); Accademia degli Agiati, Rovereto, Austria (128); K. K. Geologische Reichsanstalt, Profs. Frederick Müller, Edward Suess, Vienna, Austria (128); Naturforschende Gesellschaft des Osterlandes, Altenberg, Germany (128); "Naturwissenschaftliche Wochenschrift," Berlin, Germany (128); Naturforschende Gesellschaft, Emden, Germany (128); Naturwissenschaftliche Verein des Regierungs-Bezirks Frankfurt a. O. (128); Naturforschende Gesellschaft, Freiburg i. B. (128); Oberhessische Gesellschaft für Natur- und Heilkunde, Giessen, Germany (128); Verein für Thüringische Geschichte und Alterthumskunde, Jena, Germany (128); Verein für Naturkunde, Offenbach a. M. (128); Verein für Vaterländische Naturkunde in Würtemberg, Stuttgart, Germany (127, 128);

Dr. Henri de Saussure, Prof. Carl Vogt, Geneva, Switzerland (128); Académie R. Danoise des Sciences et des Lettres, Prof. Japetus Steenstrup, Copenhagen, Denmark (128); Académie Royale des Sciences, Amsterdam, Neth. (124, 125, 126); K. Zoologisch Genootschap, Amsterdam, Neth. (128); R. Zoölogical and Botanical Society at the Hague, Holland (128); Fondation de P. Teyler van der Hulst, Harlem, Holland (128); Maatschappij der Nederlandsche Letterkunde, Leiden, Holland (125, 126); R. Museum van Oudheiden, Leiden, Holland (128); Prof. Giovanni Capellini, Bologna, Italy (128); Biblioteca N. C., Florence, Italy (128); R. Istituto Lombardo, Milan, Italy (128); Prof. Giuseppi Sergi, Rome, Italy (128); Royal Observatory, Turin, Italy (128); Société Linnéenne, Bordeaux, France (126, 127, 128); Literary and Philosophical Society, Manchester, Eng. (128); Wyoming Historical and Geological Society, Wilkes-Barre, Pa. (128); Smithsonian Institution, Washington, D. C. (127, 128); Washburn College, Topeka, Kans. (125); Mr. Everard F. im Thurn, British Guiana (128).

Acknowledgments for 129: Philosophical Society, Cambridge, Eng.; Royal Statistical, Astronomical, Meteorological Societies, Victoria Institute, Royal Institution, Geological, Zoölogical Societies, Dr. B. W. Richardson, London, Eng.; Sir Richard Owen, Richmond Park, Surrey, Eng.; Royal Observatory, Edinburgh, Scotland; Mr. Horatio Hale, Clinton, Ontario; McGill College, Montreal; Geological and Natural History Survey, Ottawa, University of Toronto, Canadian Institute, Toronto, Canada; Botanical Society of Canada, Halifax, N. S.; Society of Natural History, Portland, Maine; Prof. C. H. Hitchcock, Hanover, N. H.; New Hampshire Historical Society, Concord, N. H.; Amherst College, Amherst, Mass.; American Academy of Arts and Sciences, Boston Society of Natural History, State Library of Massachusetts, Public Library, Athenæum, American Statistical Association, Mr. S. P. Sharples, Hon. Robert C. Winthrop, Boston, Mass.; Harvard College, Museum of Comparative Zoölogy, Messrs. Joseph Lovering, Robert N. Toppan, J. D. Whitney,

Cambridge, Mass.; Mr. James P. Francis, Lowell, Mass.; Free Public Library, New Bedford, Mass.; Dr. Pliny Earle, Northampton, Mass.; Essex Institute, Salem, Mass.; American Antiquarian Society, Worcester, Mass.; Rhode Island Historical Society, Brown University, Providence Franklin Society, Providence, R. I.; Connecticut Historical Society, Hartford, Conn.; New Haven Colony Historical Society, Yale University, Profs. O. C. Marsh, W. D. Whitney, New Haven, Conn.; Prof. W. LeConte Stevens, Brooklyn, N. Y.; Buffalo Library, Buffalo Society of Natural Sciences, Buffalo, N. Y.; Profs. C. H. F. Peters, Edward North, Clinton, N. Y.; New York Hospital, Astor Library, Columbia College, Academy of Sciences, University of the City of New York, Historical Society, Drs. Joel Allen, J. S. Newberry, John J. Stevenson, Prof. Ogden N. Rood, New York, N. Y.; Vassar Brothers Institute, Poughkeepsie, N. Y.; Oneida Historical Society, Utica, N. Y.; United States Military Academy, West Point, N. Y.; Prof. Henry M. Baird, Yonkers, N. Y.; Mr. Isaac C. Martindale, Camden, N. J.; Prof. Henry Morton, Hoboken, N. J.; New Jersey Historical Society, Newark, N. J.; Prof. George H. Cook, New Brunswick, N. J.; Profs. Henry F. Osborn, Charles A. Young, Princeton, N. J.; Dr. Robert H. Alison, Ardmore, Pa.; Mr. Martin H. Boyè, Coopersburg, Pa.; Mr. M. H. Messchert, Douglassville, Pa.; Mr. Eckley B. Coxe, Drifton, Pa.; Professors Traill Green, J. W. Moore, Thomas C. Porter, Easton, Pa.; State Library, Mr. Andrew S. McCreath, Harrisburg, Pa.; Prof. Lyman B. Hall, Haverford, Pa.; Mr. A. Pardee, Hazleton, Pa.; Mr. John Fulton, Johnstown, Pa.; Linnean Society, Lancaster, Pa.; Academy of Natural Sciences, College of Physicians, Mercantile Library, Engineers' Club, Pennsylvania Hospital, Historical Society, Numismatic and Antiquarian Society, Library Company of Philadelphia, Wagner Free Institute, Messrs. John Ashhurst, R. Meade Bache, Cadwalader Biddle, Andrew A. Blair, William Blasius, Geo. D. Boardman, W. G. A. Bonwill, Arthur E. Brown, Henry C. Chapman, C. H. Clark, Thomas M. Cleemann, Samuel Dickson, J. M. DaCosta,

Patterson DuBois, F. A. Genth, F. A. Genth, Jr., Fred. Graff, H. D. Gregory, Lewis M. Haupt, Angelo Heilprin, Inman Horner, Wm. W. Jefferis, G. deB. Keim, A. S. Letchworth, Morris Longstreth, Geo. R. Morehouse, F. A. Mühlenberg, Isaac Norris, Jr., Charles A. Oliver, Robert Patterson, H. Pemberton, C. N. Peirce, W. Pepper, Henry Phillips, Jr., Franklin Platt, Theo. D. Rand, Wm. B. Rogers, W. S. W. Ruschenberger, L. A. Scott, Coleman Sellers, Aubrey H. Smith, W. P. Tatham, H. Clay Trumbull, Wm. H. Wahl, Joseph Wharton, W. P. Wilson, Richard Wood, Theo. G. Wormley, Philadelphia, Pa.; John F. Carll, Pleasantville, Pa.; P. W. Sheafer, Heber S. Thompson, Pottsville, Pa.; George W. Anderson, Rosemont, Pa.; Lackawanna Institute of History and Science, Scranton, Pa.; M. Fisher Longstreth, Sharon Hill, Pa.; Philosophical Society, Wm. Butler, West Chester, Pa.; Wyoming Historical and Geological Society, Wilkes-Barrè, Pa.; William M. Canby, Wilmington, Del.; U. S. Naval Institute, Annapolis, Md.; Johns Hopkins University, Maryland Institute, Maryland Historical Society, Peabody Institute, Baltimore, Md.; U. S. Geological Survey, Library of the Surgeon-General's Office, U. S. Naval Observatory, Smithsonian Institution, Signal Office U. S. Coast and Geodetic Survey, Messrs. S. F. Emmons, Thomas J. Lee, Garrick Mallery, M. C. Meigs, C. V. Riley, Charles A. Schott, Wm. B. Taylor, Washington, D. C.; Virginia Historical Society, Richmond, Va.; University of Virginia, Leander McCormick Observatory, Prof. J. W. Mallet, University of Virginia, Va.; Elliott Society of Science and Art, Charleston, S. C.; University of South Carolina, Columbia, S. C ; Georgia Historical Society, Savannah, Ga.; Cincinnati Observatory, Prof. J. M. Hart, Cincinnati, O.; Prof. Leo Lesquereux, Columbus, O.; Denison University, Granville, O.; Rev. Henry S. Osborn, Oxford, O.; Michigan State Library, University of Michigan, Profs. Henry S. Frieze, Alexander Winchell, Ann Arbor, Mich.; Dr. Robert Peter, Lexington, Ky.; Athenæum, Columbia, Tenn.; Prof. Daniel Kirkwood, Bloomington, Ind.; Prof. J. L. Camp-

bell, Crawfordsville, Ind.; Chicago Historical Society, Chicago, Ill.; Davenport Academy of Natural Sciences, Davenport, Ia.; State Historical Society of Wisconsin, Madison, Wis.; Colorado Scientific Society, Denver, Colo.; Washburn College, Topeka, Kans.; California Academy of Sciences, San Francisco, Cal.; University of California, Profs. John and Joseph LeConte, Berkeley, Cal.; Observatorio Astronómico Nacional Mexicano, Mexico, Mex.

Accessions to the Library were announced from the Institut Egyptien, Cairo; K. B. Gesellschaft der Wissenschaften, Prag; Accademia degli Agiati, Rovereto; K. K. Central Anstalt für Meteorologie, Wien; Physikalische Gesellschaft, K. P. Meteorologische Institut, Berlin; P. Steiner, Darmstadt; Physikalisch-Medicinische Societät, Erlangen; Naturforschende Gesellschaft, Freiburg i. B.; Verein für Lübeckische Geschichte und Alterthumskunde, Lübeck; Verein für Vaterländische Naturkunde in Würtemberg, Stuttgart; F. v. Sandberger, Wiesbaden; Société de Physique et d'Histoire Naturelle, Geneva; Schweizerische Naturforschende Gesellschaft, Solothurn; Academie Royale, Société Royale des Antiquaires du Nord, Copenhagen; Aug. Nilson, Gefle; Musée Teyler, Harlem; Friesch. Genootschap van Geschied, Oudheid en Taalkunde, Leeuwarden; Maatschappij de Nederlandsche Letterkunde, Leiden; K. Zoologisch-Botanische Genootschap, 'S-Gravenhage; Académie R. des Sciences, etc., Bruxelles; Damiano Muoni, Milan; Société d'Anthropologie, Ecole Polytechnique, Paris; Académie N. des Sciences, etc., Caen; R. Cornwall Polytechnic Society, Falmouth; Philosophical and Literary Society, Leeds; Society of Antiquaries, Linnean Society, London; Natural History and Antiquarian Society, Penzance; Royal Dublin Society, Dublin; Mr. Horatio Hale, Clinton, Ont.; Royal Society of Canada, Montreal; Yale University, New Haven; Rev. Chas. G. Ames, Boston; Museum of Comparative Zoölogy, Cambridge; Mr. W. J. Potts, Camden; Natural History Society, Trenton; Franklin Institute, Messrs. W. G. A. Bonwill, Henry Phillips, Jr., Philadelphia; War Department, Gen. M. C. Meigs, Washington, D. C.

A fine photograph of the great elm tree on the "Dundas Estate," north-east corner of Broad and Walnut streets, said to be the oldest tree in the city, was presented by Miss Emily Phillips.

The Committees on Codex Poinsett and on Centennial Celebration reported progress, and were continued indefinitely.

The decease of the following members was announced to the Society:

Miss Maria Mitchell, b. Aug. 1, 1818, d. June 28, 1889, Poughkeepsie, N. Y.

M. Louis G. DeKoninck, Liege, Belgium.

Rev. Theodore Dwight Woolsey, b. Oct. 31, 1801, d. July 1, 1889, President of Yale College, New Haven, Conn.

Prof. Elias Loomis, b. 1811, d. Aug. 15, 1889, New Haven, Conn.

Prof. Osborn presented for the Transactions a paper on the "Evolution of the Ungulate Foot," which was referred to a committee to be appointed by the President, to examine and report upon. The President subsequently appointed Messrs. Brinton, Phillips and Horn as such Committee.

Mr. Phillips stated that the *Physa heterostropha*, whose reappearance he had mentioned to the Society on April 5, 1889, had disappeared in the first week of June, at about the same period as last year.

Pending nomination No. 1184 was read.

And the Society was adjourned by the presiding member.

Stated Meeting, September 20, 1889.

Present, 2 members.

Dr. HORN in the Chair.

The following correspondence was submitted: A letter from the Canadian Institute, Toronto, Canada, dated Sept. 5, 1889, accepting the Society's invitation to an International Congress for the purpose of forming a universal language.

A letter from Mr. C. F. Lee, dated Alexandria, Va., Sept. 13, 1889, making inquiries in regard to the "Lee papers."

Accessions to the Library were announced from the Statistika Central Byrån, Stockholm, Sweden; Philological Society, Cambridge, Eng.; Yorkshire Geological and Polytechnic Society, Halifax, Eng.; Astronomical Observatory of Harvard College, Cambridge, Mass.; Maimonides Library, New York; College of Pharmacy, Dr. Horace Jayne, Philadelphia; Department of Agriculture, Washington, D. C.

Photographs for the Society's Album were received from Dr. P. von Tunner, Leoben, Austria; Dr. C. A. Dohrn, Stettin, Prussia.

The Special Committee on Prof. Osborn's Paper reported it worthy of publication in the Transactions of the Society, and was discharged.

Pending nomination No. 1184, and new nominations 1188, 1189, 1190, 1191, 1192 and 1193 were read.

And the Society was adjourned by the presiding member.

Stated Meeting, October 4, 1889.

Present, 26 members.

President, Mr. FRALEY, in the Chair.

Prof. Henry D. Gregory, LL.D., a lately elected member, was presented to the Chair and took his seat.

Correspondence was submitted as follows, viz.:

Letters of envoy were received from the Royal Irish Academy, Royal Dublin Society, Dublin; Meteorological Office, London; U. S. Chief Signal Officer, Washington, D. C.

Letters of acknowledgment for Transactions, Vol. xvi, No. 2, were received from the K. Danske Videnskabernes Selskab, Copenhagen; K. Gesellschaft der Wissenschaften, Göttingen; Verein für Vaterländische Naturkunde, Würtemberg.

Letters of acknowledgment for Proceedings No. 128 were

received from the Royal Society of New South Wales, Sydney; Societas pro Fauna et Flora Fennica, Helsingfors, Finland; Maatschappij der Nederlandsche Letterkunde, Leidin, Holland; K. Danske Videnskabernes Selskab, Copenhagen; K. Leopoldinische Carolinische Akademie, Halle a. S.; Vogtländische Alterthumsforschende Verein, Hohenleuben, Saxony; Société de Physique et d'Histoire Naturelle, Geneva; Dr. D. G. Brinton, Media, Pa.; Sociedad Cientifica "Antonio Alzate," Mexico, Mex.

A letter of acknowledgment was received from the Naturforschende Verein, Brünn, Austria, for Proceedings, Nos. 119 to 127 inclusive.

Accessions to the Library were announced from the K. K. Sternwarte, Prag, Bohemia; K. P. Meteorologische Institut, Berlin; Prof. Leopold Einstein, Nürnberg; Royal Society, London; Dr. G. W. Leitner, Woking, Eng.; Mr. Henry Mott, Montreal; Wesleyan University, Middletown, Conn.; New Jersey Historical Society, Newark; Dr. D. G. Brinton, Media, Pa.; Prof. E. D. Cope, Mr. Henry Phillips, Jr., Philadelphia; Chief U. S. Signal Officer, Washington, D.C.

A letter from the Sociedad Cientifica Antonio Alzate, Mexico, acknowledging receipt of Proceedings 128, and asking for 129, which the Librarian reported had been sent.

A letter from the Royal Dublin Society, in reference to exchanges.

A letter from Miss Emily Malone, County Dublin, in regard to Dr. Henry's Æneida.

A letter from "The Medical News," Philadelphia, requesting exchanges, which was so ordered, to begin with No. 129.

A letter from Mr. John Fulton, Johnstown, Pa., stating his certificate of membership in the Society had been lost in the great flood that destroyed his home, and requesting a duplicate, which was so ordered.

Hon. Craig Biddle read, by appointment, an obituary notice of the late Dr. Caspar Wister.

The death of Prof. George H. Cook, New Brunswick, N. J., was announced as having taken place on September 22, 1889, in the 72d year of his age.

A memoir, by Charles R. Keyes, Burlington, Iowa, on "The American Carbonic Platycerata," was presented for the Transactions and referred to a Special Committee of three to be appointed by the President. The President subsequently appointed Drs. Ruschenberger, Brinton and Horn.

Prof. Cope read a paper on "The Philosophy of Evolution."

Dr. Ryder presented a paper on the "Phylogeny of the Sweat Glands."

A paper by Dr. Harrison Allen, on "The Genus Nyctinomus and a Description of Three New Species," was presented by the Secretaries.

Pending nominations 1184 and 1188 to 1193 were read.

The Committee on Publication reported favorably on the paper submitted by Messrs. Scott and Osborn, and that publication thereof had been ordered.

The Committee also reported that it had considered the resolution of Prof. Cope, referred to it by the Society on May 3, 1889, and suggested the following as a substitute:

Resolved, That the printers be instructed to place on the separata issued to the contributors to the publications of the Society, the name of the publication from whence they are taken and the date at which they are ready for delivery to the author.

On motion of Prof. Cope, the resolution was amended by the addition of the words, "and that both be placed on the sheets of the separata, and not alone on the cover."

And the resolution as amended was adopted by the Society.

On motion, it was ordered that the Librarian be authorized, at his discretion, to distribute the Catalog of the Society's Library to such institutions and societies, proper to receive the same, who may desire it and do not already possess it.

The President stated he had received a letter from Mr. H. A. Hill, of Boston, Mass., requesting for the Library of the Theological Seminary, Andover, Mass., such of the Society's publications as were necessary to complete its series.

On motion, the Librarian was authorized to supply the deficiencies in conformity with the practice of the Society.

And the meeting was adjourned by the President.

Obituary Notice of Caspar Wister, M.D.

By Craig Biddle.

(*Read before the American Philosophical Society, October 4, 1889.*)

Caspar Wister was born on the 15th day of September, A.D. 1818, at the old homestead in Germantown, built by his great-grandfather in 1744, and continuously occupied by the family from that date.

He was the first child of Charles Jones Wister, by his second wife, who was a Miss Sarah Whitesides.

His first school-days were passed at a school in Germantown, kept by Miss Rooker. This school, of course, he soon outgrew and was then sent to Bolmar's celebrated academy, at West Chester, where he laid the foundation for his subsequent familiarity with the modern languages. Subsequently being desirous of qualifying himself as a civil engineer, he was transferred to the school of Mr. John Gummere, then a member of our Society and a distinguished mathematician, residing at Burlington, N. J. The fame of both of these teachers yet lives in their well-known educational works—those of Mr. Bolmar being mainly confined to the teaching of the modern languages, while those of Mr. Gummere concerned the mathematics. His works on astronomy and surveying have held their own to the present day, in spite of the great competition they have met with from the works of subsequent teachers.

After graduating, he became desirous of putting into practical use the education he had received, and he determined to seek employment in some new and growing country, where as a civil engineer his services would be in request.

At that time, Texas presented, he thought, the opening which he sought. The Mexican government, as early as the year 1824, had passed colonization laws and held out inducements to citizens of the United States to settle within the limits of Texas, then one of its provinces. It soon thereafter became a point of attraction for settlers from all parts of our country. Their growing strength and steadfast adherence to republican principles aroused, however, the jealousy of the Mexican authorities, and in April, 1830, an arbitrary law was passed prohibiting any future immigrations of American settlers into Texas. The attempt to enforce this law, added to other arbitrary acts of the central government, threw Texas into revolt. In the attempt to suppress this revolt by force of arms, the Mexicans met with a crushing defeat at San Jacinto, where their army was routed by a very much inferior force, under General Houston, and Santa Anna, who called himself the Napoleon of the West, was taken prisoner. This battle secured the independence of Texas, which was subsequently recognized in 1837 by the United States.

General Houston was elected President of the new republic, and by his wise administration all further difficulties both with Mexico and the Indian

tribes were settled, and there was a fair prospect of annexation to the United States, for which he strenuously labored.

Unfortunately the President was elected for a term of but two years, under the constitutional provision, which likewise rendered him ineligible for an immediately succeeding term.

Houston, to the great regret of all, was obliged to retire, therefore, from the office until he would again be eligible, when he was reëlected. But in this interval more violent counsels prevailed, and the difficulties both with Mexico and the Indians were renewed. It was at this time young Wister reached Texas, where he found there was a much greater demand for soldiers than civilians. General Houston possessed in a high degree, both physically and mentally, those traits which made him a great leader of men. His picturesque appearance, his adventurous life, and his utter fearlessness, joined to his integrity of purpose, created especially in the young an enthusiasm that was irresistible. Wister at once yielded to it and enlisted under his banner as a first sergeant, in a regiment of mounted rifles.

After serving out his term of enlistment he returned at the end of two years to Philadelphia. He found, however, that he had not as yet overcome his attachment to a life of wild adventure, and at the end of six months he returned to Texas, and, renewing his connection with the army, served another campaign against the Indians. When this was finished, he yielded to the solicitations of his family and returned to Philadelphia. Here he was induced to enter upon the study of medicine as a pupil of Dr. George B. Wood, whose name and fame as a physician are so well known to us. In March, 1846, he graduated from the medical department of the University of Pennsylvania, his thesis being on the "Origin and Progress of Medicine." On the 20th of July of the same year, he married Miss Lydia H. Simmons, and settled down to the practice of his profession. He soon fell into a good practice, and secured the unreserved confidence and warm attachment of his patients. He was esteemed by his fellows as an able, cautious and painstaking practitioner, always intent upon the welfare of his patients.

In 1848, he became a member of the College of Physicians in Philadelphia, and the same year was elected physician of the Widows' Asylum. In 1849 he became physician of the Shelter for Colored Orphans. In 1852 he was elected a member of the American Medical Association, and in 1855 was appointed its Treasurer and a member of its Publication Committee. On retiring from his position as Treasurer, in 1877, the following resolution was passed by the Association:

"At the Twenty-eighth Annual Meeting of the American Medical Association at Chicago, June 8, 1877, on motion of Dr. I. F. Hibberd, of Indiana:

"*Resolved*, That this Association, in view of the retirement from the office of Treasurer of the gentleman who, for twenty-two years, has discharged the responsible and laborious duties of that situation, desires in this manner to express its high appreciation

of and full satisfaction with the promptness and completeness with which Caspar Wister has discharged the incumbent obligations of its financial agent, for so many years, and hereby tender to him the sincerest thanks of the Association for such long and honorable service."

Being a warm personal friend of Gen. McClellan, he accepted an invitation from him to join his headquarters at Yorktown. He accompanied the army on its advance from that point and its subsequent movement to the James river, being present at all the battles during that period, known as the seven-days battles.

So varied a life would have tempted most men to indulge, perhaps, too freely in personal reminiscences. But nothing was more distasteful to Dr. Wister than in any way to bring his own personality into prominence. Although no man was less bashful, few men were so modest. His wonderful power of adapting himself to the society he happened to be in, was the only thing which would lead you to suppose that he must have had a very wide experience of men and things. If he was wanted he was always ready when called on, provided that he could not persuade his friends that they had much better select some one else.

It was this absence of self-appreciation, connected with the fact of easy pecuniary circumstances, which alone prevented his occupying a more distinguished position than he did. Certain it is, that he never occupied any position, the duties of which he did not fill to the entire acceptance of every one.

Nothing, perhaps, shows this more clearly than the recital of the various associations, incongruous to almost any one else, of which he was a member, and generally a leading member. He was a Manager of the House of Refuge and a Director of the Philadelphia Library, President of the Rittenhouse Club and of the Board of Inspectors of the County Prison, member of the Academy of Natural Sciences and President of the Fencing and Sparring Club, Director of the Philadelphia Savings Fund and a member of this Society since 1859. All of these in addition to the Medical Association already referred to.

His nature was essentially genial; his frank, manly, unreserved manner was typical of his character. He inspired confidence at once, and a further knowledge of his clear judgment and honest sincerity confirmed it. He had a keen sense of humor, and his conversation, as well as the occasional products of his pen, were full of it. It was to be regretted that he could not be induced to write oftener for publication. A pleasant, graceful article, entitled, "A Cruise Among the Windward Islands—The Log of the *Vega*," which appeared in *Lippincott's Magazine*, in 1883, is a fair sample of his literary taste and capacity.

Dr. Wister's robust frame and temperate habits gave every indication that he would live to an advanced age; unfortunately, however, while alighting from a street car at the Pennsylvania Railroad Depot, at Thirtieth and Market streets, a runaway horse dashed against him and threw him with great violence against an iron post. The blow was so severe as to

fracture his skull. He, however, did not lose for an instant his consciousness, but informed those surrounding him, that he was about to meet Dr. I. Hayes Agnew in consultation at the residence of a patient and to send there for him at once. By the most skillful treatment, aided by his wonderful physical vigor, he apparently recovered entirely. This was in August, 1879, and almost to the hour of his death, on December 20, 1888, he pursued his usual vocation. During the last year of his life, he underwent great sufferings, from which the skill of his physicians was unable to relieve him. How far the frightful shock to his system had sapped his vitality and caused this trouble, it is perhaps impossible accurately to determine. He was entirely conscious that his life hung by a thread and realized as a physician that his case was hopeless. He died, however, like a soldier at his post, with the most serene courage and self-possession.

His first wife having died in 1848, Dr. Wister was happily married a second time on June 26, 1854, to Miss Annie Lee Furness, who survives him, as well as his daughter by his first wife, Mrs. Clifford B. Rossell.

An Outline of the Philosophy of Evolution.

By E. D. Cope.

(*Read before the American Philosophical Society, October 4, 1889.*)

Mental processes are divided into those of presentation and those of representation, or those of perception and those of ideation. A vast difference distinguishes the physiological action of these two forms of mentality. Sensuous perception is a more distinct, sometimes even a violent state of consciousness, while ideation is a much less distinct condition, although the range of its degrees of impressiveness in consciousness is very great. In a conflict between perception and ideation for the control of consciousness, the former can nearly always win, temporarily at least, in the healthy organism. But the impressiveness of perception is perhaps the cause of its remarkable transitory character. It is a fact of great importance that sensations cannot be exactly reproduced in memory, while ideas can be so reproduced. Sensations leave residua, it is true, which are the materials of ideation, but it is only ideas which memory preserves in their original form. It has been suggested * that this result is due to a destruction of tissue caused by the greater energy of sensations; while ideation, less violent, is principally constructive, organizing brain molecules into

* American Naturalist, 1886, p. 83.

relations of position which faithfully reproduce the primitive form of consciousness when consciousness recurs in them. This fact indicates that ideation is a constructive agent, a proposition which receives support from the history of animal evolution in general. It must be remarked, however, that the forms of ideation differ much in their constructive power. Emotional ideation is far less constructive than the intellectual, and of the intellectual faculties, the rational is the most persistent.

Ideation, in the wide sense, falls into the three classes indicated by Kant, those of the intellect, the emotions and the will. In the process of evolution of animals the faculties of each of these classes have played an active part in adapting the individual to the environment; in changing its environment; and in directing the movements of its organs; thus affecting its structure through use and disuse. As the primitive motive in all action, we may assign the emotions in their various forms, as the appetites, the tastes, and the affections; the emotions proper constituting the extreme expression of the class. The manner in which these execute their behests and indeed the decision as to whether they shall find executive expression or not, is determined by the intelligence. The act of execution is the will. On a purely physiological explanation of the relation between stimulus and consequent act, the word will is superfluous. But if there be any purely mental process involved which cannot be explained on dynamical principles, then the term will has an important significance. The mental activities then which have so influenced the process of animal evolution (and perhaps other evolution) fall under the two heads of motive and executive faculties, and the motives to action are either emotional or intelligent; or, as is usually the case, of the two in mutual interaction.

At this point we at once reach the ancient question of realism and idealism. We are confronted with the crux of human thought, whether there be any forms of ideation which are not representative; and also whether the forms of ideation determine the properties of matter, or whether they are themselves determined by the properties of matter; and therefore whether the presentative forms, or the sensations, reveal to us a real universe not of our own making, or not. The answer to these questions constitutes our knowledge of the relations of mind to matter. On these depend the most stupendous events. These are nothing less than the persistence or extinction of mind, both that of finite beings like ourselves, but also the extinction of all mind. If mind have no sufficient control over matter, then the dissipation of energy, which inheres in the the processes of matter, must end in the extinction of mind. If on the contrary, mind has a sufficient control over matter, then we must view it as a constructive principle at work, to which the integration of matter and dissipation of energy are but secondary or complementary.

Hitherto the nature of cognition has been chiefly considered in the realist-idealist discussion, but the nature of will is equally involved in it. Free will is in some sense *a priori* will or unconditioned will. I propose

to devote a few pages to this old question, both as to the intellect and the will. My apology for doing so is that our knowledge of evolution is now greater than has been the case hitherto ; and also because it appears to me that the attempt to develop a metaphysical system on a basis of Darwinian evolution has been only partially successful. Let us see what results follow the introduction into philosophy of the Lamarckian principle of evolution.

I. The Intellect.

Given perception (presentation) and memory (representation), and we have the materials for the unassisted evolution of *human* intelligence in both its departments of the imagination and the reason. That such development has resulted under the conditions imposed by the environment can be doubted by no one who has studied animals. Such has been clearly the origin of the human mind with all its noble powers. It by no means follows from this fact that there have not appeared in many human minds faculties which greatly transcend anything which we observe in the highest of the Mammalia below him. In the first place, it is probable that ideation in the latter never extends beyond induction, and, in a more limited degree, deduction ; and that neither of these faculties are ever applied to their subjective states, although they evidently are applied to those of other animals and of men. And it is necessary for evolutionists to believe that the origin of the human mind being what it is, it is quite impossible that any ideas should exist in it which are not of experiential or empirical origin, no matter how much they may transcend those of the lower animals. Thus to the lessons of experience are traced the highest generalizations, as the "categories of reason" of Aristotle, and of Kant, and the fundamental axioms of mathematics and of logic. This follows necessarily from the fundamental realism of evolution, which posits the existence of tridimensional resistant matter which exhibits the two qualities of motion (energy), and in some of its forms, consciousness (mind), neither of which can transcend the limits inherent in the nature of dimensions and resistance. Thus we reach the inevitable conclusion, as pointed out by Spencer, that even the highest human faculties have been attained by experience, by slow acquisition and inheritance. And this apparent spontaneous appearance of the high powers of generalization in the mind is under this hypothesis due to the perfecting of the machine during the phylogeny of the race, by inheritance by the individual, and not to any *a priori* or intuitive powers which it possesses.

It is a curious fact that many thinkers on these subjects hold the evolutionary doctrine above described along with the idealistic philosophy. In other words they maintain, at the same time, two doctrines which are, in their extreme forms, contradictory, and mutually exclusive. If the origin of the human intelligence by evolution be true, then the theory of idealism, which is the prevalent philosophy of the century, is false ; and *vice versa*. And yet the same men cling to both, and are unable, naturally, to

harmonize them. And there is indeed truth, as usual, on both sides of the question, which will form, when harmonized, a consistent whole, and a true philosophy.

The truth of realistic doctrine is demonstrated not only by the fact of evolution, but by the general result of scientific research. The indestructibility of matter and the conservation of energy have been demonstrated in a vast number of instances. If our knowledge of the varied properties of matter is defective, the defect is growing rapidly less, and no limit can be put upon our progress in this direction. But apart from this, it is safe to infer what we do not know of the properties of matter from what we know, very much as we can infer the general characters of the lost parts of the anatomy of a vertebrate animal from its skeleton alone. Moreover, the mind is as capable of perceiving disorder as order. It appreciates the disorder of a wrecked building as readily as the order of increments of wave-lengths, of chemical equivalents, or of cusps on the tooth of a mammal; and although the knowledge of order and of disorder is organized in the subjective, the order we observe in nature is not in us, but it is in nature; it is objective, and not subjective. It is the cause of our perceptions, and our perceptions are not the cause of it.

What are the truths of idealism? Kant, while admitting the validity of sense perceptions, in opposition to pure idealism, asserted that they are only comprehensible to us through a subjective and *a priori* form of thought, and that we understand objects in accordance with that form, and not as they are in themselves. And first of all the forms of thought, those of space and time, constitute the basis of our interpretations of Nature as we see it. It is this qualified idealism of Kant which the evolutionist needs chiefly to consider.

The question has been often debated, Are these fundamental forms of thought *a posteriori* or *a priori;* are they known by experience or are they deeper than experience? If evolution be true they are only known to man, as Bain asserts, by experience. But the question again arises, Is the human mind all there is of mind in the universe? To say the least of it, such a view is open to serious question; and by most rational persons a negative reply, based on probabilities, would be promptly given. To my own understanding the restriction of mind to this speck called the Earth is highly improbable, and any assertion to that effect appears to be without sufficient basis. There being doubt then as to this point, we are compelled to examine again the qualities of mind itself to see whether there is any ground for a belief in its possession of *a priori* qualities. In this quest from an evolutionary standpoint we can have but one criterion. We cannot assume that any of them can be developed in men without experience, but we can ascertain whether any of them *are in themselves equally true in the absence of experience of an objective universe, as with such experience.* Such faculties, if possible, could be predicated in varying degrees of minds dwelling in environments differing from those of this planet, and of minds which might have existed before evolutions should have

reached their final stages here or elsewhere. In other words, such faculties would characterize mind in general as distinguished from, yet including, the human mind. But I must here insist that such mind cannot be conceived to exist apart from a dimensional (material) basis of some kind.

This classification of thought is different from the division into the contingent and the absolute, since both of these types are to be found in the experiential and in the *a priori* fields. The axiomatic properties of matter, dimensions and resistance, are not contingent, but absolute; while the movements of matter are contingent on each other and the sources (in the mental field) from which they may be derived. So also in the *a priori* field. While the axioms of logic are not contingent, many of the activities of mind are contingent on each other (and also on those of other persons) and on material conditions.

It is obvious that there are truths which are equally valid with and without the material of experience. It is also true, as shown by Aristotle, that there is a scale of generalizations, which is at the one extremity purely experiential, and at the other purely formal; and that the intermediate members of the series are on the one side experiential and on the other formal. The categories display this double validity. On the one side they express the relations of objects, and on the other, those of thoughts. Even the simple method of induction is applicable to mental noumena as it is to material phenomena. But the highest generalizations clearly have a validity independent of experience, although our race may not have discovered them without it. These are, *first*, generalizations which are exclusively formal. These are the two fundamental axioms of logic; viz., the maxim of contradiction and the maxim of excluded middle. *Second*, generalizations which, while valid as forms of pure thought, are also deducible from experience. These are Time, and the categories Modality, Relation, Quality and Quantity (Kant), etc.

The fundamental and only form allowed by Rosmini, is the "intuition of being." In its subjective human application this is the basis of the "Cogito" of Des Cartes, and the Ego of Fichte. In the same sense it is the "self-consciousness" of the evolutionary psychology. In its broader aspect it may include consciousness of all grades, and as such is a postulate of the mentality of animals as well as of men. Kant includes space with time in the forms of thought. This cannot, it seems to me, be admitted. Space is not in any sense a form of thought, but is derived from experience of matter, of which it is one of the two definitions. It is certainly not a condition of thought, as time evidently may be, *i. e.*, as succession of thoughts. This one characteristic of Kant's system made it idealistic rather than realistic.

In the following table I arrange the contents of cognition in accordance with the principles above indicated.

		Experiential, a posteriori principles.		*Formal, a priori principles.*	
Material objects.	Properties.	Inductions.	Inductions.	Categories, etc.	Pure forms of thought.
Dimensions. (Space.)	Total;	Classifications based on shape.		Order in time.	The axioms of Logic; *i. e.*, Maxim of Contradiction; Maxim of excluded Middle.
	External;			Quantity.	
	Internal, etc.			Quality.	
				Relation.	
				Modality.	
Resistance. (Motion or energy.)	Molar.	Causes and effects, and classifications based on them.	Psychological science.		
	Molecular; *e. g.*, temperature; color; vitality, etc.				

The relation of these several functions of mind to its objective or material basis is both destructive and constructive. Physiological science and common experience show that they cannot be performed without the usual decomposition of matter and dissipation of energy. But evolution shows that they have also done something else of a diametrically opposite character. In the course of ages they have built up on the Earth, by successive increments, a mechanism whose function has been that of continuously developing mind. And this continuous development of mind means successive increase of control over the environment; in short, the development of a control by mind of matter. How this can have been accomplished may be considered in the following pages which treat of the will.

II. The Will.

The will has two aspects from which it may be viewed, the physical and the metaphysical. As the link between thought and action it represents the contact of the one with the other. If all thought be mechanical, then will does not differ from other links in the chain of causation. If, on the other hand, the universe be a psychic product, will is again but a passing phase of the stream of thought. But if mind be an attribute of matter, whose existence depends on its own success in resisting a tendency to extinction, then will is something definite, which presents the two aspects already referred to. The will, as the executive power of the mind, is either free, or it is determined by antecedent mental conditions; or as a function of matter, it is free, or it is determined by present physical conditions. Which of these propositions is true is the second question of the ages.

On the metaphysical side the will is determined by preëxistent motives, or appears to be. The situation is such that the negative of this statement cannot be clearly proven. A will which acts without motives is incomprehensible. Motiveless acts cannot be regarded as mental. It has been suggested that there is an opportunity for metaphysical freedom of will in situations and under circumstances which are prior to experience. But even in cases where there is a defect of experience, an almost inconceivable condition, the imagination will furnish motives. It is impossible to escape metaphysical determinism.

The physical action of the will is less simple. In the performance by an animal of a reflex act, we believe that the act is the direct result of a stimulus which passes into a mechanism so constructed as to release energy in the direction of, and to the end to perform, the act in question. Into such a process there enters no distinct element called will. In an animal possessed of intelligence, to ever so limited an amount, the direction of an act not reflex, is due to the presence of consciousness in the performance. This consciousness is generally supposed to exercise a directive influence until the movement has been thoroughly learned, or has become automatic, a term which is applied to acts more nearly allied to the voluntary

than are the reflex acts. The effect of the interference of consciousness is to give the act the character of design, or a direction designed to satisfy some consciously felt want. Such design is also displayed by reflex and automatic acts, but it is impossible to suppose that these have originated in any other way than as results of voluntary (consciously directed) acts by the ordinary and well-known process of automatization (cryptopnoy). Any other theory of their origin is incredible.

The process of performance of the voluntary act involves then an antecedent metaphysical element which constitutes its motive. Motives, as already mentioned, are derived from the emotions and from the intelligence. They may be classified as follows:

Emotional; { Appetites, Tastes, Affections, Passions.

Intelligent; { Imaginative, Æsthetic, Rational.

In various proportions and degrees some or all of these faculties interact as motives in all animals from the Amœba to man.

It has been denied that the metaphysical element enters into the performance of an act. The reason for this opinion is clear. An act by an animal is a contraction of protoplasm, either undifferentiated or as muscular fibrilla. To produce this movement a communication of motion is necessary. The metaphysical motive cannot, however, be weighed. The existence of the motive represents an expenditure of energy in the arrangement of the molecules (of the brain cells in an animal with a brain) which shall express such a form of consciousness, but there can be no correlation of energy between the significance of the motive and such expenditure of energy. Since an idea (motive) has no ponderosity, it cannot communicate motion to a nerve or muscle cell. Hence a metaphysical state cannot direct an act. For similar reasons the converse of this proposition is true. Material conditions can have no effect on mind, for that which has weight cannot impress or modify that which has no weight. Matter cannot control mind.

The only answer to this position is that it is contrary to the facts as observed. To deny that a state of consciousness can influence a current of energy, is to assert that animals do not eat because they are hungry, nor drink because they are thirsty. It is to assert that unconscious acts possess the same design in new and unexpected cases, as conscious ones, a statement which we know to be false. It is to assert that the muscles of the human tongue are not controlled by motives when engaged in the use of language. It is in fact to contradict the daily observation of mankind in thousands of instances. It is easier to believe that metaphysical

states in the form of motives control the direction of energy in spite of all the difficulties involved in the belief.

There is, however, evidence that such is the case apart from direct observation. On no other hypothesis is it possible to account for the evolution of the mechanism of the brain, the organ of mental phenomena, and of the remainder of the organism which is so well adapted to minister to its necessities. The evidence furnished by evolution is to the effect that continuous use (and disuse) of parts of the body for definite reasons (mostly appetites) have modified their form, and that such modifications have been inherited and added to by succeeding generations, until a high degree of specific adaptation, or specialization, has been reached. And this specialization is profitable to its possessor, enabling it to resist the antagonistic energies of nature, and thus to escape the early "integration of its matter and dissipation of its energy." In no other way can the development of man be accounted for, in whom the upward and progressive opposition to the downward and retrograde law of dead matter has reached its highest expression. The designed acts of animals have ever protected and multiplied them, and given them, in ever-extending degrees, control of their environment. This cannot be accounted for on any hypothesis excepting that here maintained, viz., that the metaphysical condition enters into the designed act and determines its nature or direction. The attempt to account for this evolution on the basis of natural selection exclusively, is a paralogism, since a selection does not account for the origin of anything, and evolution is the history of the origin of things.

We may now return to the consideration of the chacteristics of an act of will. The first stage in the performance of an act is the formation of a judgment. This is simply the complete balance of the motives. It is a metaphysical process, a weighing of considerations derived from purely mental sources, in which the result is reached, not by comparing actual weights, but by comparing sensations and generalizations. In execution, the direction of the act is strictly derived from the judgment in the first place, and is only secondarily derived from the object of the act. Thus an animal projects one ear or the other under the influence of a single motive, curiosity. An animal climbs a tree or hides in a hole under the influence of the same motive, viz., fear. A man worships a fetish, a Brama, or a Budda, under the single influence of religious feeling. He gives to any beggar that applies to him, under the direction of the one motive, benevolence. It is evident in all of these cases, which are but illustrations of the universal fact, that the expenditure of energy in the act of willing has no measurable relation to the result attained. Thus an animal or a man may expend more or less energy in performing any of the acts cited, according to material circumstances; as for example, the length or shortness of the ear; the height or distance of the tree; the earnestness of the worshiper, the manner of his worship, etc. Still less is there any correlation between the expenditure of energy in the brain

of the actor, and the effect of his acts on society, the world, etc., and for the same reasons. His acts enter other minds as motives, and the same process is repeated, indefinitely.

To repeat the proposition in a summary form. The character of an act of will is derived from two factors. *First*, subjective, the motives already existent in the mind; *second*, objective, the object or end towards the accomplishment of which the act is directed. In neither the first nor the second process is the law of the conservation of energy observed *on the metaphysical side*, though it doubtless is on the physical side. That is, in the formation of motives there is no correlation between the reasons adopted as sufficient, and the energy expended in weighing them. Secondly, there is no correlation between the direction taken by the act, and the energy expended in performing it. The reason for this second proposition is identical with that which explains the first. The direction or object of the act is also due to motives which only differ from those embraced in the first proposition in their later origin in time.*

The relation of these facts to the physiology of an act of will is as follows. The stimulus to act enters the brain by the sensory channels and comes, probably in the cortical cells of the anterior lobes of the hemispheres, into the structural mechanism of the intelligence. Here a mechanism exists, formed under the direction of all the mental faculties of ideation, from which a judgment issues. Or if the case be a new one, a rearrangement of molecules takes place as the combined result of the old and the new ideas, and a new judgment is formed. Here we have repeated the primitive process of creation of ideational centres. Next, the judgment furnishes the form for the outgoing act, which then repeats, on the objective world, including the person of the actor, the rearrangement of matter under its direction. Thus are modified at once, under the same judgment, the animal and its environment.

The extent to which a judgment is creative, evidently depends on its purity as judgment; only the "colorless judgment" is absolutely creative. As has been already pointed out (page 495), when discussing memory, the reproduction of mental function becomes more complete as we approach the rational faculty, and *vice versa*; it grows less as we pass successively to the imagination, the emotions, and least of all as a sequence of sensations. The coincidence of this fact, with the utility of intelligence, is not accidental. And we may then conclude that the highest creative power resides in exercise of *a priori* or formal thought, on the ground of physiological economy. We may conclude that, although the will is always strictly determined from the metaphysical side, it is free from necessity on the physical side, save only that imposed by the dimensions and resistance of matter. And in the coincidence of formal thought, which is universal thought, with conditioned freedom of will towards matter, we have the essentials of creative power, and a creative personality.

* American Naturalist, June, 1888, On the Relation of Will to the Conservation of Energy.

III. Critical.

The system outlined in the preceding pages falls within the field already cultivated by Schopenhauer and especially by Hartmann. This is distinguished from those occupied by the older metaphysicians in the important function assigned to will. The older schools, both idealistic and realistic, occupied themselves chiefly with the discussion of the principles of cognition. The philosophy of evolution requires something more than this. If there be anything beyond the world and human life on it, it can be only discovered by an investigation of the nexus between mind and matter. And if there be any nexus at all, in which the mind is not entirely subordinate, it is will. If there be any directive principle at the bottom of evolution it is to be found by research in this direction.

What this will is in its essence I have attempted to show in the preceding pages. It is regarded as the *realization* of thought, as is done by Hartmann; or as the expression of energy, the degree and nature of whose rationality depends on mental conditions. But the system differs totally from the two philosophies in question in being a philosophy of the conscious and not a "philosophy of the unconscious." Automatic and unconscious will are derived from the conscious by cryptopnoy, and not the reverse. The result is thus theistic and not atheistic, and optimistic and not pessimistic. It is the Darwino-Hartmannian system inverted. For although Hartmann's system promises progress through pain, as must any system of evolution, it does not furnish any rational basis for progressive evolution, but is essentially retrogressive, pessimistic, and nihilistic. It is Darwinian and not Lamarckian.

As regards the fundamental doctrine of Spencer, the relativity of knowledge, the present method brings us to the result, that the scope of such relativity diminishes directly as the generalization in constitution of the physical basis of mind. For this method postulates the existence of mind as prior and not subsequent to organization, a fact demonstrated by organic evolution. And although so long as there is a physical basis there is no "absolute" in action, the will is sufficient for creative functions, both subjective and objective.

PROC. AMER. PHILOS. SOC. XXVI. 130. 3L PRINTED NOV. 18, 1889.

The Ethnologic Affinities of the Ancient Etruscans.

By Daniel G. Brinton, M.D.

(*Read before the American Philosophical Society, Oct. 18, 1889.*)

The problem of the ethnologic position of the ancient Etruscans must be considered as yet unsolved. In spite of the prolonged labors of Corssen and Deecke, the theory that attached the Etrusci to the Indo-European stock rests on such feeble foundations that it is rejected by some of the ablest specialists in this branch; while the Turanian or Ugric origin, so vehemently advocated by Dr. Isaac Taylor, Mr. Robert Brown, Jr., and others, is now dismissed as untenable by all the continental Etruscologists.

As for those other hypotheses which connect the inhabitants of Etruria with the ancient Copts, with the Israelites, with the Lydians, with the Armenians, with the Hittites, with the Celts, with the Basques, and what not, they never had enough in their favor seriously to attract the attention of scholars.

One defect in these theories has been that they were all based on one ethnic element only. Their authors seem unaware that in the present condition of ethnologic science it is insufficient to deduce conclusions from the language only, or the arts only, or the legends, or the physical features only, of a nation; all these must be taken into account where the problem is complex, and the verdict of each must be carefully weighed.

My attention was especially called to this problem while spending some months in Italy early in the present year, where I had the opportunity of seeing the many museums of Etruscan antiquities which are so intelligently preserved and displayed in that country.

I had reached the Italian shores by the most ancient traveled route from the coast of Africa, that, indeed, which was taken by the pious Æneas himself, sailing from Carthage by way of the Isle of Pantellaria to Marsala, the ancient Lilybœum.

On a clear day one is rarely out of sight of land on this crossing; for no sooner do the bold headlands on either side of ancient Carthage sink in the south-west than the volcanic cone of Pantellaria rises in sight; and when that is lost to view the mount-

ainous coast of Southern Sicily is soon perceived. The distance between the two islands is not quite sixty English miles, an interval of space which was not enough to offer any serious barrier to even very early ploughmen of the Mediterranean main.

I dwell on these geographic details with a purpose, as you will see later; and I mention the fact of my journey in Africa, as it was the observations I made there which first led me to the conclusions I am about to present in this paper. Part of my time had been passed on the borders of what is called "la Grande Kabylie," that portion of the province of Algiers which is inhabited by the Kabyles, the most direct descendants of the ancient Libyans.

They are a strange people, these Kabyles, both in customs and physical aspect. Natives of Africa time out of mind, many of them present the purest type of the blonde races, blue or gray eyes, tawny beard, fair complexion, curly light or reddish hair, muscular in build and often tall in stature. When I came to look at the many evidently portrait busts on the tombs of the ancient Etruscans, there was something in the features, in the shape of head and face, which reminded me of these Kabyles. Slight as it was, it induced me to compare the two peoples in other details, and it is the result of this comparison which I now submit to be weighed and judged by those competent in such matters.

§ 1. *Geographic Position of the Ancient Etruscans, historically considered.*

Etruscan remains are found in Italy from the Gulf of Salerno to the River Po, and from the Tyrrhenian sea to the Adriatic. One inscription, indeed, has been unearthed at Verona,* perhaps one near Chiavenna, and even at Chur I was shown one, in the Rhætian Museum, which the curator averred had been dug up near that city. Certain it is, however, that the right bank of the Po was substantially the northern limit of Etruscan culture.†

They were essentially city-builders and city-dwellers, and at the height of their power, which we may put about five or six

*See Mueller, *Die Etrusker*, Bd. I, s. 157. References to this important work are always to the second edition (1877), edited by Deecke.

† Comp. Prof. G. Sergi, in the *Archivio per l'Anthropologia*, 1883, p. 139.

hundred years before the Christian era, they appear to have had three federations of twelve cities each, within the limits I have named. This statement might easily lead to an excessive idea of their numbers; but it is well ascertained that the Etruscans constituted by no means the bulk of the population. They were only the ruling class, a slave holding aristocracy, while the large majority of the inhabitants belonged to native Italian tribes, as the Umbri, the Osci, the Ligures, and others.

All the ancient writers recognize the Etruscans as intruders on Italian soil, and they themselves are said fully to have acknowledged this, and indeed to have had certain legends as to the time and place of their first permanent settlement on the peninsula. It is only in utter defiance of these semi-historic reports that Virchow and others* bring them down from the Alps, across the plains of Lombardy, through the defiles of the Appenines, and at length to the shores of the Tyrrhenian sea. Neither the classical historians nor the Etruscans themselves knew a vestige of such a tradition. The erudite Otfried Muller, who has collected everything to be found in Greek and Latin literature concerning them, states that it is the unanimous testimony of antiquity that the earliest Etruscans reached the western shore of Italy, crossing the sea from the south; and he adds that it is undeniable (*unleugbar*) that such was the belief of the Etruscans themselves.† We know that by tradition and religious customs they assigned as their first permanent settlement the city of Tarquinii, the modern Corneto, on the shore of the Mediterranean, twelve miles north of Civita Vecchia. To this venerable site the priests and soothsayers resorted from all parts of Etruria to perfect themselves in the pure and ancient "Etruscan discipline." Here their hero-god Tages, a wondrous gray-haired boy, sprang into life from a ploughed furrow, and taught their ancestors the mysteries of the diviner's craft and the nobler arts of life. This locality, I say, according to uniform tradition, was where their progenitors first established themselves, crossing the sea from somewhere to the south. Such a tradition, so definitely preserved, cannot be cast aside without sound reasons.

The date of this landing has been given by Müller at about

* Prof. Virchow has expressed this opinion in the *Verhandlungen der Berliner Gesellschaft für Anthropologie*, 1884, p. 208, and elsewhere.

† *Die Etrusker* Bd. 1, ss. 66, 67, sqq.

two hundred and ninety years before the founding of Rome, while other writers are inclined to put it earlier by five hundred years. Between a thousand and twelve hundred years before the Christian era is probably as near as we can now fix it.

Now that the extensive excavations in Etruscan sites enable us to have a survey of the whole field of their operations, it is conceded more and more that the line of their migration was from south to north, from cisapennine to transapennine localities. Their settlements at Marzabotto, Bologna and beyond were visibly later and of briefer duration than in Etruria proper.* The Etruscan alphabet of North Italy also reveals plain marks of degeneration, and the forms of the inscriptions are less archaic.†

§ 2. *Physical Traits of the Etruscans.*

We do not have to depend upon guess-work for a knowledge of the physical features of the Etruscans; we have a vast realm of mimetic art preserved, much of it unquestionably faithful to the originals, and in spite of the frequent custom of incineration, hundreds of genuine Etruscan skeletons have come down to us in a good state of preservation.

It surprises me that, in spite of this, and although the anthropometric results I am about to quote have been published for years, Dr. Deecke, in his recent edition of Müller's *Etrusker*, takes no note of them, but repeats the old statement that this people was short in stature, heavy-set, obese and dark.‡ Of course Dr. Isaac Taylor,§ in order to give countenance to his theory that the Etruscans were Turanians, is glad to adopt this opinion. He would not have liked to take cognizance of the modern anthropologists who have studied the subject, for nothing more fatal to his theory can be imagined than their results.

The old notion seems to have arisen from expressions in two late Roman poets, Virgil and Catullus, who speak of the Etruscans as fat; *pinguis Etruscus* and *obesus Etruscus* are their

*Speaking of Marzabotto, the "Etruscan Pompeii," Prof. Eduard Meyer says in a recent article: "Sie zeigt, dass die Nachricht der Alten richtig ist, welche die Etrusker von Süden her ins Po-Land vordringen lassen." *Correspondenz-Blatt der deutschen Gesell. für Anthrop., Ethnol. und Urgeschichte*, Januar, 1889. He is fully supported by Prof. Sergi and most of the Italian archæologists who have studied the remains on the spot.

†Müller, *Die Etrusker*, Bd. ii, s. 529.

‡*Die Etrusker*, Bd. i, s. 64, note.

§In his work entitled *Etruscan Researches*.

words. It has also been commented on that the Etruscan cinerary urns frequently represent short, stout men, with disproportionately large heads and arms. This, however, was merely a technique of the national artists. They often put all their work on the upper, and effaced the lower portion of the figure, as not presenting individual characteristics. Where the full figure is shown, as in some beautiful specimens in the Museum at Florence, the squat appearance referred to is not apparent.

Fortunately we do not have to rely on the contradictory testimony of art to learn the stature of the Etruscans. The Italian anatomists have measured two hundred of their skeletons and from these have deduced, in accordance with well-known osteologic rules, the height of the average individual. The result shows them to have been an unusually tall race, the average of the two hundred persons having been 1.75 metres, or very nearly five feet nine inches.* This is greater than the average height of our soldiers during the war, which was 1.70 metres, and is rather above the average of the soldiery of any European nation to-day, though less than some of the picked corps, the French carabineers, for example. It is a little more than the average stature of the Algerian Kabyles, who, nevertheless, are a tall race, averaging above 1.70 metres.†

Dr. Taylor and his followers do not fare better when it comes to cranial measurements. The typical skull of the Turanian stock is short and roundish—brachycephalic; that of the Etruscan was markedly of the long type—dolichocephalic. MM. Hovelacque and Hervé quote the results of three extended measurements of the cephalic index by Italian craniologists as showing 75.6, 76 and 77.3.‡ Less than a fourth of the crania can be called brachycephalic.§

It is interesting to compare these figures with measurements from the skulls of the modern descendants of the ancient Libyans—the Kabyles. According to data furnished by two excellent observers, MM. Topinàrd and Lagneau, these are respectively 76.7 and 77.3, almost absolutely the same as for the old Etruscans.

There is a current tradition in Italy that the Etruscans were

* Paul Topinàrd, *Eléments d'Anthropologie Générale*, p. 498 (Paris, 1885).

† *Ibid.*, Chap. xiv.

‡ Hovelacque et Hervé, *Précis d'Anthropologie*, p. 577 (Paris, 1887).

§ A number of authorities are quoted to this effect by Prof. G. Sergi, in the *Archivio per l'Antropologia e la Etnologia*, 1883, p. 140.

blondes, with light hair and blue eyes. I met a Tuscan wine-merchant who lived near Florence, and he pointed with pride to his handsome blonde beard, informing me that his family claimed Etruscan descent and that his beard was proof of it! There is evidence from ancient art that this piece of folk-lore is correct, and the eminent anthropologist I have just quoted, M. Topinard, sums up, with his usual correctness, our anthropologic knowledge of this people when he says: "From the evidence before us we may decide that the Etruscans were of large stature, blondes, and dolichocephalous; while their predecessors, the Umbrians, were small and brachycephalous." *

In all these physical traits we discover a coincidence with the ancient Libyan or true Berber type, as seen in the Kabyles of the Djurdjura mountains, the Rifians of Morocco, and the former inhabitants of the Canary islands, the Guanches. There is no doubt but that the last mentioned were a true branch of the Berber stock. The fragments of their language, which have been collected and critically edited by Sabin Berthelot † and others, prove that it was closely allied to the dialect of the Morocco Rifians. Their skeletons show them to have been an unusually tall race, quite a number of individuals ranging from six to six and a half feet in height.‡ Their skulls present the same dolichocephalic index as the Kabyles, and that they were largely blondes is attested by the early navigators, who speak of their long yellow hair reaching down to below their waists.§ The presence of these blondes on the Canaries destroys the theory sometimes advanced that the blonde hue of the Kabyles arose from admixture with the Goths, at the period of the dissolution of the western empire; for the Canaries were peopled by the Berbers long before the Christian era, and Dr. Verneau has quite recently discovered Numidian inscriptions there.‖ But for that matter this hypothesis is untenable for other reasons. The blonde Berbers are referred to on Egyptian monuments, and as for the

* "Les Etruscains etaient grands, blonds et dolichocephales," *Elèments d' Anthropologie*, p. 498.

† *Antiquités Canariennes*, Paris, 1879.

‡ Dr. R. Verneau, *La Taille des Anciens Habitants des Iles Canaries*, in the *Revue d' Anthropologie*, 1887.

§ "Crines longos et flavos usque ad umbilicum ferè," says the chronicler of the expedition sent out by Alphonso IV. Ample evidence is collected by Berthelot in the *Bulletin de la Société d' Ethnologie*, 1845, p. 121, sqq.

‖ *Revue d' Anthropologie*, 1887, p. 650.

Goths in Africa, they had entirely disappeared as early as when Procopius wrote his history. *

All this goes to show that the physical type of the ancient Etruscans was the same as that of the ancient Libyans and entirely distinct from any then existing on the Italian or Hellenic peninsulas. This identity can be traced in other features of importance to the anatomist. The orbital index of the modern Kabyles is 88.1, of the Etruscans 87.4, a remarkable approximation; the nasal indices of both range between 44 and 49; in both there is a lack of accentuation of the cranial prominences. †

§ 3. *The Culture Elements of the Etruscans.*

Wherever the first settlers of Tarquinii came from they do not seem to have brought with them the higher arts of life. Most of these were later acquisitions, learned from their neighbors, the Greeks of Sicily and Magna Grecia, and in longer voyages for trading and piracy, which extended to Greece itself, to the coasts of Asia Minor, to Egypt, and to the Semitic cities of Palestine and their colonies at Carthage and elsewhere. Etruscan art yields positive testimony to all these influences, especially that of the Greeks. The Etruscan alphabet appears to me to have been derived directly from the Greek, and not from the Phenician, as Rawlinson‡ and others have thought. We must carefully exclude all these external borrowings if we would make a correct comparison of real Etruscan culture-traits with those of other nations. When this is done, it will be found that, in some characteristics, they stood in bold relief from all the nations I have mentioned.

No one of these is more conspicuous than the position assigned to woman in Etruscan civilization. It was in astonishing contrast to her place among the polished Greeks, and still more so to her station in oriental life. With the Etruscans, evidently a strictly monogamous people, she was the equal and the companion of her husband. She sat by his side at the feasting board, she was

* Quoted by Berthelot, *ubi supra*, p. 141, note. Topinàrd identifies the Libyans with the *Lebou* and *Tamahou*, enemies of the ancient Egyptians, and figured on monuments of the Nineteenth Dynasty as of lofty stature, blondes, with blue eyes and long, waving, yellow hair. *Elèments d'Anthropologie*, p. 209.

† The details of these measurements may be found in the works of Topinàrd and of Hovelacque and Hervé, already quoted.

‡ In his work, *The Origin of Nations* (New York, 1881).

cared for in the most attentive manner, her image was carved with his on their common tomb, and there are a thousand evidences that she was not merely the idol, but the honored helpmate of the man. It was from this Etruscan example that early Rome drew the principle of monogamy and of the substantial independence of woman; and whatever we have of that noble element in modern life, it is a legacy through Rome from ancient Etruria.

This was decidedly neither a Hellenic nor an eastern principle, but we do find it from the earliest times among the Berbers. Even in spite of the polygamous doctrines of Mohammedanism the woman still retains her position in Kabyle life as the companion and helpmeet of man. Their *Kanoun*, or ancient code of laws, often in conflict with the Koran, and always respected in preference to it, protects her autonomy in a variety of ways,* and the independence of her position has been a frequent theme of comment with travelers.

Another marked and peculiar element in Etruscan life was the recognition of the principle of confederation in politics. Their league of twelve independent cities was the first of its kind in the ancient world. Canon Rawlinson forcibly points out how far it was superior to the temporary and unstable alliances of the Greeks.† In this lay the secret of the rapid and great success of Etruria.

Here again is a singular identity with North Libyan governmental features. The very word *Kabyle*—the Arabic *q'bail*—means "confederation," and refers to their ancient system of a political union of thoroughly independent communities. Nor is this a recent growth. The name by which the Kabyles were known to the Latin writers was *Quinquegentes*, "the Five Nations," referring to the coalition which then as now existed among them.

The Etruscans were bold navigators. For more than a century—600–500 B. C.—they were the virtual masters of the Mediterranean. It may be objected that in this they were unlike

* The *Kanoun* of the Algerian Kabyles has been published, in full, by MM. Hanoteau et Letourneux, *La Kabylie et les Coutumes Kabyles* (Vol. iii, Paris, 1873). See also on the position of woman among the Kabyles, L. Piesse, *Algerie et Tunisie*, p. lxv (Paris, 1888).

† In the *Origin of Nations*, above quoted.

the Libyans; but it must be remembered that the Libyans undoubtedly did at that time venture out into the Atlantic as far as the Canary islands and peopled them—a greater distance from land than the passage of the Mediterranean requires.

I can not pursue this parallel in other directions, for lack of material. We know something about the Etruscan religion; but Christianity and Mohammedanism have effaced every vestige of the ancient cult of the Berbers. The architecture of the Etruscans was wonderful, but beyond the fact that the ancient Libyans were builders of megalithic monuments and of dwellings of cut stone,* little has come down to us regarding their knowledge of this art.

§ 4. *The Etruscan Language.*

One of the ablest of ancient historians, Dionysius of Halicarnassus, asserted that the Etruscan language was *sui generis*, without affinity with any other. Such seems to have been also the most recent verdict of modern linguistic research. Dr. C. Pauli, one of the best authorities on it now living, pronounces all attempts to trace its relationship to be failures;† and Dennis, the learned English Etruscologist, states his opinion that it is as isolated as the Basque.‡ Dr. Pauli, indeed, decries all attempts to trace, in the present state of our knowledge, its affinities, and himself sets the example of studying it from its own monuments alone.

These monuments are not insignificant. We have preserved to us, more or less complete, over six thousand inscriptions in the Etruscan alphabet and language, a few of them bilingual, usually with the Latin. We know the value of the Etruscan letters, and up to a certain point the phonetics of the tongue. Some words have been preserved to us in Greek and Latin writers with their meanings, and the sense of others can be approximately made out from their recurrence in a great many inscriptions of a certain

* There is evidence from Latin writers that the Tuariks, one of the purest blooded of the Berber tribes, constructed dwellings of cut stone before the advent of the Roman legions. For the extracts showing this, see an article by N. Bibasco, on the Kabyles, in the *Revue des Deux Mondes*, Dec., 1865.

† In his suggestive essay, *Die wahre und die falsche Methode bei der Entzifferung der Etruskischen Inschriften*, printed in the *Altitalische Studien* for 1885.

‡ *The Cities and Cemeteries of Etruria*. Introduction.

class. We also have the numerals, and a multitude of proper names, personal and geographic.

If with this apparatus at command I venture to disregard Pauli's warning, and to institute a comparison between the Etruscan and Libyan languages, it is because I think the material is sufficient at least to be worth the attention of students. So far as I know, no one has attempted any such comparison before; nor do I find that this possible origin of the Etruscans has as yet been advanced, obvious as it seems to be.

One reason of this has doubtless been the extremely little available knowledge of the Libyan tongues, ancient or modern. What we do definitely know may be briefly rehearsed.

The modern Libyan, or Berber, is spoken by hordes scattered from Timbuctoo to the Mediterranean, and from the shores of the Atlantic to the borders of Egypt. It is divided into a number of dialects which are phonetically grouped into two classes, the "strong" and the "weak," characterized by the regular transformation of certain consonantal sounds, principally *k* to *l*, *t* and *θ* to *d* or *r*, *s* to *ch*, etc. When the action of these phonetic laws is understood and allowed for, the fundamental unity of all the dialects becomes apparent, both in their vocabulary and grammar.*

The themes are both nominal and verbal, but the latter are much the more numerous and form the grammatical characteristic of the group. They are nearly all consonantal, and may be of one, two, three, or four letters, subject to internal vowel change, and modification of the idea by prefixes and suffixes.

The modern Kabyle, which has adopted many Arabic words, is written with the Arabic alphabet, which, however, does not render correctly some of its sounds. The Touareg, the dialect of the desert, has preserved an alphabet of its own, no doubt a form of the ancient Numidian, which in turn was derived from the Semitic Carthaginian. The Tamachek, as this venerable A B C is called, does not express the vowel sounds nor separate the words. It is said to have been retained principally through the efforts of the women, who are the literatæ of the tribe.†

* René Basset, *Manuel de Langue Kabyle*, p. 3 (Paris, 1887).

† This statement is made by Bibasco, in the article above quoted, *Revue des deux Mondes*, Dec., 1865. The Tamachek alphabet is given by Hanoteau in his *Grammaire Kabyle* (Paris, 1860). This writer adds that the Touareg is one of the purest dialects of the Berber tongue (*id.*, Introd., p. xiii).

The ancient Libyan or Numidian was the parent stem of these dialects. Some hundreds of inscriptions in it have been preserved, a few of them bilingual, so there is a possibility that we may recover the grammar of this now lost tongue.* Prof. Newman, indeed, has made an effort to restore it from modern Berber dialects;† but I am surprised that he has made no use of this valuable epigraphy.

These various Libyan dialects form the western branch of a large family of tongues, of which the eastern branches include the modern and ancient Coptic, the Abyssinian and others. The whole family has been called *Hamitic*, or *Cushite*, or *Proto-Semitic*, of which terms the first is the best, simply because it conveys no preconceived hypothesis. The grammar of all the Hamitic languages shows similar traits. The nouns have a masculine and feminine form; the radical may be of one or more syllables and, unlike the Semitic tongues, it remains unaltered in the process of word-building; there are plural but not dual forms; relation is expressed by both prefixes and suffixes; and the verb originally had but one form, instead of the two or more found in the Semitic languages.‡

The general grammatic aspect of these languages, however, leaves no doubt but that at some remote epoch they were derived from the same original form of speech from which the Semitic languages trace their descent; hence, they are classified as the *Hamito-Semitic* stock.

Where was the original seat of the tribe who spoke this parent tongue has not been ascertained. The uniform opinion of scholars has been that it was somewhere in Western Asia; and though the question does not immediately concern the present discussion, I cannot forbear adding that I hold this to be a mistake, and that the original seat of the Semites was on or near the Atlantic coast.

It is with the Libyan branch of the Hamitic family of languages that I shall proceed to compare the ancient Etruscan.

* They have been edited by General Faidherbe, Prof. Halévy, Renan and others.

† *Libyan Vocabulary: an Essay toward reproducing the Ancient Numidian Language.* London, 1882.

‡ These are substantially the characteristics of the family as traced by Friedrich Müller in his *Grundriss der Sprachwissenschaft*, and by Hovelacque in his work, *La Linguistique.*

The Etruscan alphabet, as I have already said, was derived from the Greek. It represented twenty sounds, as follows:

Vowels: a, e, i, u.

Mutes: c (=k), p, φ, t, θ, χ (guttural).

Linguals: l, r.

Nasals: m, n.

Sibilants: ś, s, z (ś = soft *s*); (z, originally *ts*).

Spirants: h (spiritus asper), v (= u), f (the digamma).

It will be noticed that the vowel *o* was not expressed, and that a number of consonantal sounds found in Latin and Greek are absent.

The orthography of the Etruscan inscriptions shows either that these letters did not fully express the sounds of the language, or else that it possessed many phonetic variations. The principal of these are as follows:

k into *f*, *χ*, *φ*, *θ*, and *vice versa*.

t into *θ*, *h*, *d*, and z, and v.v.

s into *c* or *z*, and v.v.

Initial *e* and terminal *n* were often omitted.

It is certain there were various vowel sounds which were not written; there is no doubt, for instance, of the identity of the forms *epl* and *pul*; of *eprθne* and *purθne*, etc. The extent of these changes has very properly been made a subject of careful study by the epigraphists.*

Very little has been gleaned from the inscriptions as to the grammar of the Etruscan. The best authorities on the subject are Deecke and Pauli, and both agree that the Etruscan nouns have a gender presenting masculine and feminine forms, by this cutting the language off of all connection with the Turanian stock. The nouns have also plural terminations, and both nominal and verbal themes are modified by suffixes and less frequently by prefixes. Pauli considers the demonstrative pronouns to be, "without doubt," *an*, *cen* and *mi*(*n*).

Conjugations and declensions have not been fixed, though it is believed that a terminal *s*, often attached to words, is the sign of the genitive or possessive case; and a terminal *ce* seems to indicate a past tense in verbals. A terminal *-c* and *-m* are supposed to be suffixed copulative conjunctions, like the *-que* in Latin.†

* On these phonetic variations, see Pauli in *Etruskische Forschungen und Studien*, 1882, Heft iii, ss. 18, 23, 27, 28, etc., and elsewhere. Also Deecke, Appendix on the Etruscan Language, in Müller's *Die Etrusker*, Bd. ii.

† For these particulars, compare Deecke in *Etruskishe Forschungen und Studien*, 1882, Heft ii, s. 62, sq., and Pauli in the same, Heft iii, s. 146, and elsewhere.

These meagre outlines give small chance for comparison; but there is nothing in them to contradict the theory of Libyan affinities. The latter has also masculine, feminine and plural forms of nouns, and though it has strictly no declensions, the terminal *s* is found in it with the same possessive signification. It is not a case ending, but the possessive pronoun of the third person, "his" or "her."* As for articles,† definite or indefinite, there is none, either in Etruscan or Libyan.

The ascertained vocabulary of the Etruscan is a short one. The classical writers have handed us down a few words more or less disfigured no doubt; and certain constantly recurring words on inscriptions give chance for a fair guess as to what they must mean. From these sources I present the following list, marking those from ancient writers with an asterisk, and some from modern students with their initials.‡ The list includes, I think, every Etruscan word of which we know the probable meaning.

Etruscan Vocabulary.

**aesar*, deity, divinity.
**antar*, eagle.
**aukelos*, aurora, dawn.
**ataison*, the vine.
aθ, man, *vir*, D.
ara, race, family, "gens," P.
atar, family, P.; house, D.
avil, year; old; aged; "ætas."
alpan, image, statue; gift; "supplex," E.

zama, gold, P.
zilaθ, a priestly title, D.

θura, descendant, D., P.; brother, Sch.
θrafna, cup, vase.
θaura, grave, sepulchre.
θui, he lies, "cubat;" *θui cesu*, "hic cubat."

* Thus, *akhkham*, house; *akhkhamis*, his or her house. Basset, *Manuel de Langue Kabyle*, p. 12. The suffix is either *s*, *is*, or *es*.

† Prof. A. H. Sayce has attempted to show that the suffixed *-s* or *-es* in Etruscan is the definite article; but I have not observed that this opinion has been adopted. *Altitalische Studien*, 1883, Heft ii, pp. 127, 128.

‡ P. — Pauli; D. — Deecke; E. — Ellis; Sch. — Schaefer B. Bugge, etc.

iχu, a stone (or *eχu*).
itun, a pot, a vase, P.
**ituo*, to divide.

eca, this; here, P. Subst. verb "to be," D., B., etc.
etera, a freedman; a slave; a servant.

ca, this; *cav*, in this; or ceher, or cn.
ceχa, tribe, P.; an official priestly title, meaning holy; or sexigenarius from *ceχa*, sixty, P.
ceχasie, a priest or priestly title.
capi, a vessel, a cup.
clan or *clen*, a son, P.; "sepulchral," from *cela*, grave-vault, "grabkammer," B.; "soboles or princeps," E.
caru, or *cares*, or *cerinu*, or *cerixu*, a monument or tomb; a memorial; "sculpit," E.
cver, a gift; a present; an offering; "soror," E.
**cassis*, a helmet.

hinθia, a ghost or departed spirit.

**falando*, the sky, heaven.
frontac, the lightning thrower, "fulguriator."
farthana, monument, P.

**lar*, lord or chief; a household god; elder brother.
**lücümo*, a prince, a priest, lit. "inspired," "possessed."
lautni, slave; freedman; family.
leine, died; to die; "vivit," E.
lupu, to die; died; dead.

maru, *marva*, or *marnu*, a priestly title, D.
malena or *malstria*, a mirror.
mi, this, P.; to be, D.
muki, a cup, a bowl.
mur or *mur-s*, a grave, a sepulchre.
mulun, to give; to dedicate or consecrate.
mutna, a tomb, a sepulchre.

penθna, a stone, P.
puia, a wife, P.; a daughter, E.

ril, to live, lived; *ril avil*, "vixit annos;" a year, E.

**tamnos* (δαμνος), a horse.
tular, a stone; a monument; public, D.; tomb, E.
tur-, to give, to make an offering.
tiv-s, moon, month.
trvtnvt, a soothsayer, Lat. "haruspex."
tesan, a dedication; ten.

usil, sun, day.

**verse*, fire; "averte."

çleres, a statue, an image; an offering.

nefts, grandson; probably Latin "nepos."
netsvis, augur.
nipe, cup, vase.
nesl, a grave, a sepulchre, "mortuus," E.
nacnva, a grave, a tomb.

spura, town, city, commonwealth, "res publica," D.; conqueror, P.
seχ, daughter.
svthi, sepulchre, tomb, burial place, D.; "it is," P.
sιθic, property; it belongs to, P.
svaι-ce, to live, lived.

There are a number of these words which, I think without straining, may be explained from Libyan roots. I take them up in the order in which they are arranged in the vocabulary:

Aesar, a god. This may be derived from the Libyan (Tuareg) *asr*, light; *esan*, lightning; as *deus* from *deva*, the bright, the shining one. The lightning is the constant accompaniment of the chief Etruscan deity.

Aukelos or *ankelos*, the dawn, the daybreak. This appears certainly to be allied to the Kab. verb *akker*, to rise; *θenker*, the sunrise, the dawn.

Ataison, the vine; Kab. *θsa*.

Aθ, man; *ara*, descendants, gens; *atar*, family. These are extremely important words, frequently recurring on the sepulchral inscriptions and at the commencement of proper names; also in the connection *clen-ar-*, "son (?) of *ar-*." They constitute one of the strongest points of evidence of the Libyan origin of the Etruscans, for in all the Libyan tribes this syllable *at-*, *ar-*, *ath* or *ait*, is the sign of tribal kinship, like the *Beni* of the Arabs. In the dialect of the Guanches it appears with precisely the same form and meaning as in Etruscan, *at*, *ad* and *ar*, as the initial syllable of many words.* In the Tuareg we find *arach*, offspring, etc. All are from an ancient Libyan monoliteral root R, seen in Kab. *arou*, *erou*, aor. *irou*, "produire, engendrer," *l'arach*, "tribu," etc.†

Alpan, an image or statue. This seems to me the most likely meaning of the word. In the Tuareg dialect *awan*, which has the same signification, seems a weakened form of the same root.

Zilaθ; believed by Deecke to be the title of a priest. This is probable, and connects it with the Kab. *zelir*, aor. *izla*, to sacrifice; the *zilaθ* being the "sacrificer."

θura, descendants, children (D. and P.); brother (Sch.). This is another striking identity between the Libyan and Etruscan in terms of relationship. It is the Kab. *θerga*, Guanche *t'hu-*, as a prefix to the name of a gens. These parallels confirm the correctness of the rendering of the inscriptions.

θrafna or *θarfna*; a cup or bowl. Compare the Berber *tarbut* or *tarfut*, an earthen dish.

Iχu or *eχu*, means a stone or something of stone; *cerixu*, a stone tomb. The same root seems to appear in Kab. *azekka*, a stone tomb.

Ituθ, an Etruscan word preserved by Festus, with the meaning "to divide." It seems plainly identical with the Kab. *ibdha*, to divide; Tuareg, *itzun*, he divided.

Cver, to give, is not remote from the Kab. root *fkr* with the same signification.

* Berthelot, *Mémoire sur les Guanches*, calls especial attention to this linguistic trait as connecting the various Berber tribes.

† P. Olivier, *Dictionnaire francais-kabyle* (Le Puy, 1878). I do not much rely on this work, as it lacks critical value.

PROC. AMER. PHILOS. SOC. XXVI. 130. 3N. PRINTED DEC. 11, 1889.

Eca; this word begins many inscriptions, and appears to mean "this" or "here," and has been usually so rendered. It would thus correspond with the Kab. *agi*, which has the same senses. Others think it the substantive verb; Kab. *eg*, to be, aorist, *iga*.

Ca or *ke*, rendered by Pauli as the demonstrative "this," is identical in sense and sound with the Kab. demonstrative *gi* (*g* hard).

**Lar;* this term frequently occurs with *aruns*, and by some the former is supposed to be elder, the latter younger brother; or that *lar*, *lars*, or *alarθ* = chief, lord. I suspect both are from the Libyan root *ar*, to beget, engender, whence Kab. *argaz*, man, etc. See above under *aθ*.

Maru; a priestly title. Comp. Kab. *mer*, to teach.

Mur-s, grave; properly "his grave." Com. Kab. *mūth*, death; *emmout*, or *emmeth*, to die; *medhel*, to bury.

Mutna, a tomb; probably from the same Libyan root, *mut*, as *mur*, q. v.

Tamnos, a horse. This may be a Hellenized form of the word for "mare," Kab. *thagmarth*, where the *th* initial and final is the sign of the feminine gender.

Tur, to make an offering. Comp. Kab. *θarzefth*, pl. *tirdzaf*, an offering.

Tiv-s, moon, month. Comp. Kab. *tiziri*, moon, month.

Usil, sun, day. The Kabyle term for the midday sun is *asal*, and it is noteworthy that the Etruscan day began when the sun was at high noon.*

The Etruscan Numerals.

It is confidently believed among Etruscologists that we know the words for the first six numerals in that language. They are found inscribed on a pair of dice exhumed near Toscanella in 1848. A serious difficulty presented itself, however, in ascertaining in what order these words should be read. The majority of ancient dice have the pips so arranged that the sum of the opposite sides equals seven, thus: 1+6, 2+5, 4+3. A number of North Etruscan dice have been reported where this is not the order, but the following: 1+2, 3+4, 5+6. Dr. Pauli avers that no other order of the pips

* Müller, *Die Etrusker*, Bd. ii, s. 301.

on Etruscan dice has been observed;* but in this he errs, as Mr. Stewart Culin, who closely examined the Etruscan dice in the British Museum, informs me that more than ten per cent of them show yet other arrangements, so that it is quite possible that the dice from Toscanella should be read on a scheme differing from both the above.

The six words on the dice in the order in which I should propose to read them are:

maχ, ci (ki), zal, huθ, θu, sa.

In assigning these their respective values of 1, 2, 3, 4, 5, 6, I am supported by many of the leading students of the subject, as the following list will show:

Etruscan Word.	*Value.*	*Authorities in favor.*
ma,	1,	Campanari, Pauli, Taylor, Ellis, Bugge, Brown.†
ci or *ki,*	2,	Taylor, Deecke, Brown.
zal,	3,	Campanari, Taylor, Ellis, Brown.
huθ,	4,	Campanari, Pauli, Ellis.
θu,	5,	Taylor, Brown, Pauli.
sa,	6,	Campanari, Bugge, Ellis.

I need not rehearse the evidence in support of these values. It is derived from patient comparative study of inscriptions in which these numerals occur, and is certainly as well substantiated as any other.

It is well known that the numerals present a most valuable standard of linguistic comparison, and the utmost efforts, therefore, have been put forth to exhibit some relationship of the above words to the numerals of some other tongue. The result has been utter failure in every instance, as has been vigorously stated by the acute

*"Antike Würfel mit anderer Ordnung giebt es durchaus nicht." Pauli, *Etruskische Forschungen und Studien*, 1882, p. 11. So far is this from being correct that I have the notes of over a dozen irregular ancient dice, observed by M. Culin in the collection of the British Museum alone.

†Mr. Robert Brown's article is the latest study of Etruscan numerals. It is in *The Archæological Review*, for July, 1889. Unfortunately its value is impaired by the writer's devotion to Dr. Taylor's notion of the Turanian origin of the Etruscans. Pauli on *Die Etruskischen Zahlwörter* may be found in the *Etruskische Forschungen und Studien*, for 1882; and Bugge partial discussion of them in the same journal for 1883. For Ellis' opinion see his *Asiatic Affinities of the Old Italians*, p. 51, seq.

investigator, Pauli.* So far as I know no comparison of them with the ancient Libyan has heretofore been attempted.

It is important at the outset, to note that the above numeral adjectives belong to a rather late Etruscan period, and do not present the ancient forms of the words. These have been obtained by a comparison of ancient inscriptions, and are presented as follows, by Pauli and others:

1, *meχ*;† 2, *cin*; 3, *sals*;‡ 4, *hut*; 5, *θuns* or *fnes*;§ 6, *sas*.

These are the forms which we must use for our comparison as being the most archaic.

A similar process must be carried out with the modern Libyan numerals; we must restore them to their earliest forms.

At present the Kabyles employ the Arabic numerals for values higher than two. Recourse must be had, therefore, to the Tuariks and other tribes who retain the old expressions. An examination proves that the ancient Libyan was a quinary system, based, as most primitive numeration, on counting the fingers. The word for hand, *fous*, still means *five* in several of the dialects, as the Djerba and the Mzab.‖ In these quinary systems, drawn from the fingers, the word for *one* often means "the little one," referring either to the short thumb or the little finger. At present the word for *one* in the Berber dialects is some variation of *en*, which seems a loan word from the Greek or early Latin (ἑν, *unus*). Probably their native expression was *mekk*, or *meχ*, which means "a little one;" for not only is that in accord with the general rule of quinary tongues,¶ but we find the Cretans used the word ἄμαχις, borrowed, probably, from the Libyans, in the sense "a single one" (Bugge).

* His words are: "So wenig die Etruskischen Zahlwörter indogermanisch sind, so wenig sind sie mit irgend einer andern bis jetzt verglichenen Sprache verwandt, sie stehen bis jetzt vollständig isolirt," *ubi suprâ*, p. 148.

† See C. Pauli on the Etruscan Inscription in the Museum of Leiden, in *Altitalische Studien*, 1884, p. 61.

‡ Bugge gives as other forms of *sal*, these variants—*zeral*, *zelar*, *zerar*, *zerin*, *Etrusk. Forsch. u. Studien*, 1883, p. 156.

§ The form *fnesi*, where *θ* has passed into *f*, a frequent permutation in the inscriptions, is quoted by Bugge, from the Inscription F. 2335d.

‖ Basset, *Manuel de Langue Kabyle*, pp. 70, 71.

¶ "Number," says J. Hammond Trumbull, in his philosophical essay on the numerals in American tongues, "begins at 'two,' and we may assume that 'two' was the first *named* numeral, though an earlier *conception* may be expressed in the name given to 'one.'" He adds that, in "many" American languages, the expression for "one" means "the little one," "the least," the reference being to the finger. *Transactions of the American Philological Association*, for 1874, pp. 50, 72.

The modern Libyan for *two* is *sin;* for *three*, *karat* (in the Gdhames dialect, *kalat;* in Bilin, *sadu* or *salu*); *four* in modern Kabyle is *akoz*, which may be remotely connected with the word for four in the eastern dialects of the Hamitic family (Coptic, *feθu* and *ftou*); *six* in Kabyle is *sez*, in the ancient dialect of the Guanches (Canary islands), *sas-etti*, evidently identical with the old Coptic *sas*.

With these restorations I would place the two alphabets side by side as follows, showing the consonantal roots at the base of the numerals in accordance with the spirit of the Hamitic languages:

Archaic Etruscan.	*Archaic Libyan-Hamitic.*
1. M°χ.	M°χ.
2. S^{i}n.	S^{i}n.
3. S^{a}l.	S^{a}l.
4. F^{u}t.	F^{u}t.
5. F^{u}ns.	F^{u}s.
6. S^{a}s.	S^{a}s.

The similarity here displayed appears to me quite convincing that the Etruscan, if not a Libyan dialect, was certainly a branch of the Hamitic family, with closer relations to the Libyan than to the eastern dialect of the family.

It would be profitable to continue this comparison between the Libyan and Etruscan into the domain of proper names, geographical, personal and tribal, for which there is considerable material. At some future time I hope to accomplish this, but at present I shall confine myself to two prominent examples, one, the native names of the Etruscan people, *Rasena*, or Etrusci, the other, the name of their hero-god or mythical tribal ancestor.

The historian, Dionysius of Halicarnassus, states that they called themselves "*Rasena*," and the forms *rasn* and *rasnia* are found on inscriptions, in connections where the signification "people" or "folk" would be suitable.* On the other hand, Dr. Pauli believes that there is strong testimony that their native name began with *turs*, which, by elision of the vowel and adoption of a suffixed *e*, became *Etrs-ci*, or more fully *Etrusci*.†

*Ras'an, populus; *rasena*, popularis; *ras'nia*, Etruria, are the proposed renderings of Pauli. *Altitalische Studien*, 1884, p. 60.

† "Das vorgeschlagene *e* ist im Etruskischen mehrfach nachweisbar. *Etrusci* = *Etrsc* = Tursci—dies ist ein Beweis das der *einheimische* Name der Etrusker mit *turs* begann." Pauli, *Etrusk. Forsch. und Studien*, 1882, p. 18.

The only method to bring these statements into unison is to consider RʿS the biliteral radical; *et* or *'t*, the prefix; and *enna* and *ci*, suffixes of different sense. This suggestion harmonizes the inscriptions, bears out the statement of Dionysius, and moreover finds its explanation in the Libyan. The prefix *et* or *'t* is the modern *ait*, Guanche *at*, which I have before shown is repeatedly seen in Etruscan. It conveys the sense "the children of Ras," or "those of Ras." What this "Ras" may mean I am not sure; but that it was a local name of some importance in ancient Libya is evident from the list of Roman bishoprics before the arrival of the Arabs, two of which, in the heart of the Kabyle country, were named *Rus-ucurru* and *Rus-azouz*.* The termination *enni* in Kabyle is the suffixed demonstrative pronoun, and is equivalent to "those of Ras," or "the Rases," supplying the place, in a manner, of the prefix *et*.† The *ci* (ki) or *χi* is a suffix which appears also to be demonstrative.

The name of their hero-god, considered by some to be allied to the radical *turs*, is *taɪχ*. It is seen in the appellations *Tarquinius*, *Tarchetius*, and the like. These doubtless refer back to *Tarchon*, the mythical founder of the first settlement at Tarquinii, and the father or finder of the hero-god *Tages* (*Taɪχes*), to whom I have before referred. To him the royal line of the Tarquins traced their origin. It is not easy to combine this radical with *ras*, and I prefer to believe them distinct. In the form *taχ* or *tar*, it is quite common in the Libyan dialects. It appears in the name of the Numidian rebel who gave the Emperor Tiberius so much trouble, *Tacfarinus*, and M. Berthelot pointedly calls attention to its frequency among the Guanches of the Canaries.‡ The signification of the radical I leave for future investigation, mentioning, however, the root A-GH-L or A-GH-R in modern Libyan, from which the Kabyle words *aghalik*, king, and *θagheldiθ*, kingdom, are de-

* Hanoteau et Letourneux, *La Kabylie et les Coutumes Kabyles*, Tome i, p. 312. This of course proves that it is not the Arabic *ras*, head, cape.

† Basset, *Manuel de la Langue Kabyle*, p. 17. This suffix is invariable, *e. g.*, *argaz-enni*, that man; *irgazen-enni*, those men. It occurs elsewhere in Etruscan as Cicenna, Vipina, Spurina, Pors-enna, etc. Bugge thinks it appears in the termination *annat*. See *Etruskische Forschungen und Studien*, 1883, Heft iv, ss. 4–6.

‡ *Mémoire sur les Guanches, in Mémoires de la Société d'Ethnologie*, Tome ii. One might be inclined to bring the tribal appellation *Tuarek* into this connection; but Wetzstein and others consider it an Arabic form from *terek*, "relinquere." See *Zeitschrift für Ethnologie*, 1887, p. 35.

rived, the latter of which would give the Latinized forms *tac* or *tarq*.

In conclusion, I would submit the following as the results of this inquiry:

1. The uniform testimony of the ancient writers and of their own traditions asserts that the Etruscans came across the sea from the south and established their first settlement on Italian soil near Tarquinii; this historic testimony is corroborated by the preponderance of archæologic evidence as yet brought forward.

2. Physically the Etruscans were a people of lofty stature, of the blonde type, with dolichocephalic heads. In these traits they corresponded precisely with the blonde type of the ancient Libyans, represented by the modern Berbers and the Guanches, the only blonde people to the south.

3. In the position assigned to woman and in the system of federal government the Etruscans were totally different from the Greeks, Orientals and Turanians; but were in entire accord with the Libyans.

4. The phonetics, grammatical plan, vocabulary, numerals and proper names of the Etruscan tongue present many and close analogies with the Libyan dialects, ancient and modern.

5. Linguistic science, therefore, concurs with tradition, archæology, sociologic traits and anthropologic evidence, in assigning a genetic relationship of the Etruscans to the Libyan family.

Stated Meeting, October 18, 1889.

Present, 20 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Correspondence was submitted as follows, viz.:

A letter from Bureau of Statistics of Labor, Commonwealth of Massachusetts, offering its publications to the Society and requesting exchanges, which was so ordered.

A letter from the Commissioner of Public Records of Parishes, Towns and Counties of Massachusetts, in reference to records reported as missing.

A letter from the Geological Survey of Missouri requesting exchanges, which on motion was so ordered.

Letters of acknowledgment were received from the Deutsche Geologische Gesellschaft, Berlin (127); Academie Royale des Sciences, Lisbon (Transactions, xvi, 1; Proceedings, 128); Phillips Academy, Andover, Mass. (Transactions [N. S.], i–xv, xvi, 1; Proceedings, 96–110; Catalogue, Parts i–iv); Rev. J. A. Murray, Carlisle, Pa. (128).

Acknowledgments for 129: Prof. Serge Nikitin, St. Petersburg; Prof. Peter R. von Tunner, Leoben, Austria; K. K. Central Anstalt für Meteorologie und Erdmagnetismus, Dr. A. Brezina, Vienna; Deutsche Geologische Gesellschaft, K. P. Meteorologische Institut, "Naturwissenschaftliche Wochenschrift," Berlin; Verein für Erdkunde, Dresden; Vogtländische Altertumsforschende Verein, Hohenleuben; Verein für Thuringische Geschichte und Alterthumskunde, Jena; Verein für Naturkunde, Offenbach a. Main; Dr. Carl August Dohrn, Stettin; R. Comitato Geologico, Rome; Prof. Abel Hovelacque, Paris; Prof. Lucien Adam, Rennes, France; Royal Dublin Society; Royal Society of Edinburgh; University Library, Prof. J. P. Postgate, Cambridge, Eng.; Society of Antiquaries, Mr. C. Juhlin Dannfelt, Sir James Paget, London; Literary and Philosophical Society, Manchester; Sir Henry W. Acland, Prof. J. J. Sylvester, Oxford; Dr. Alfred R. Selwyn, Ottawa, Canada; Rev. J. A. Murray, Carlisle, Pa.; Dr. D. G. Brinton, Media; Messrs. Samuel Castner, Jr., Edwin J. Houston, George Stuart, Philadelphia; Elisha Mitchell Scientific Society, Chapel Hill, N. C.; Mr. Everard F. im Thurn, Georgetown, British Guiana.

Letters of envoy were received from the K. P. Akademie der Wissenschaften, Berlin; Citizens' Committee of the Constitutional Centennial Celebration, Philadelphia.

Accessions to the Library were announced from the R. Geological Society of Australia (N. S. W. Branch), Sydney; K. K. Geologische Reichsanstalt, Vienna; K. Akademie der Wissenschaften, Berlin; Neues Archiv für Sächsische Geschichte und Altertumskunde, Dresden; Prof. E. Renevier, Lausanne;

R. Academia de Ciencias, etc., Madrid; University Library, Cambridge, Eng.; Editors of "Nature," London; Mr. W. E. A. Axon, Manchester, Eng.; Citizens' Committee of the Constitutional Centennial Celebration, Editors of the "Medical News," Commissioners for the Erection of the Public Buildings, Messrs. Clarence H. Clark, Henry Phillips, Jr., MacCalla & Co., Philadelphia; Commissioner of Labor, Washington, D. C.; State Historical Society, Madison, Wis.; Lick Observatory, Sacramento, Cal.

The Special Committee on the paper by Charles R. Keyes reported progress and was continued.

The stated business of the meeting was then taken up, and pending nominations Nos. 1184, 1188, 1189, 1190, 1191, 1192, and 1193 were read, spoken to and balloted upon.

Prof. Daniel G. Brinton read a paper on "The Ethnologic Affinities of the Ancient Etruscans."

Prof. John A. Ryder read a paper on the "Proofs of the Effects of Habitual Use in the Modification of an Animal Organization," upon which some remarks were made by Prof. Cope, Dr. Allen and Dr. Horn.

Dr. Horn made the following remarks:

The mention of *Scarabæus* (Ateuchus) *sacer* by Prof. Ryder brings forward several species in our own fauna. *Deltochilum gibbosum* has no anterior tarsi in either sex, and, like the *sacer*, might be used as an evidence of the persistence of a character gradually acquired through repeated mutilation, that is, a loss of the tarsus by the digging which these insects perform. On the other hand, the numerous species of Phanæus do quite as much digging and the anterior tarsi of the male only are wanting. It is true that many females are seen which have lost their anterior tarsi by digging; have, in fact, worn them off; but in recently developed specimens the front tarsi are always absent in the males and present in the females. If repeated mutilation has resulted in the entire disappearance of the tarsi in one fossorial insect, it is reasonable to infer that the same results should follow in a related insect in both sexes, if at all, and not in the male only. It is evident that some other cause than inherited mutilation must be sought for to explain the loss of the tarsi in these insects.

Prof. Edwin J. Houston made the following oral communication upon "Crystal-Studded Hail Stones:"

The hail storm which occurred at Philadelphia, near sunset, on October

1, 1889, presented some peculiarities which the author desires to place on record.

The storm was heralded by the usual bands of dark clouds and a high wind velocity. A fall of rain was followed by a copious fall of hail. The storm was of short duration and was rapidly followed by a clear sky.

An examination of a number of hail stones which fell on a grass plot in the northern section of the city showed the following peculiarities, viz.:

(1) Most of the larger stones examined were nearly spherical in shape, with only a slight tendency to an oblately spheroidal shape. Some of them varied in diameter from an inch to an inch and a quarter.

(2) The smaller stones were, on the contrary, so markedly oblately spheroidal as to closely approach in many instances the shape of flat discs.

(3) Cross sections of the stones showed the usual concentric layers of alternate opaque and transparent ice.

(4) The nucleus of the stones examined was of opaque ice.

(5) The outer layer of nearly all the stones, and without exception of all the larger stones, was of opaque ice.

These peculiarities are common to nearly all hail stones, and are only referred to in connection with a peculiarity I have never before noticed in hail stones, nor have I ever seen the same referred to in the literature of the subject.

On the outer surface of a number of the larger stones examined, well-marked crystals of clear transparent ice projected in some instances for a full quarter of an inch. These crystals, as well as I could determine from the perishable nature of the material, were six-sided prisms with clearly cut facets, and well-marked terminal faces. The crystals projected from the surface of the stone in the direction of their greatest length. They closely resembled the crystals so common in geodes where the mineral matters are slowly deposited from the mother liquor.

The size and transparency of the crystals, and the well-defined character of their edges and faces, indicated their formation under conditions favorable to crystalline growth, among the most essential of which are time, and comparative freedom from motion during formation.

It would appear, therefore, that the stones must have been in a condition of actual or comparative rest in a mass of vapor-saturated air for a short interval of time after their formation, and immediately before their fall to the earth.

The conditions of rapid motion so usually assumed in the generally accepted theories for the formation of hail are so opposed to such a rest of the hail stones, that the condition of rest in the stones appears to be improbable, unless such theories be considerably modified.

It has been suggested, however, that an actual rapid motion of the stone, while surrounded by an accompanying mass of vapor-laden air, would place the stone in a position of relative rest as regards the air, and so give the crystals the opportunity required for growth.

Whatever meteorological conditions may have existed during the forma-

tion of these crystal-studded hail stones, are apparently unusual, since such stones are far from common.

I have called attention to the phenomena, not for the purpose of suggesting any explanation for the formation of these peculiar stones, but merely to place on record an observed fact.

After all the other business of the meeting had been disposed of, the ballot-box was opened by the Secretaries and the votes being counted the result of the poll was reported to the presiding member, who declared the following to have been duly elected members of the Society, viz.:

No. 2160. Walter J. Hoffman, Washington, D. C.
No. 2161. J. W. Powell, Washington, D. C.
No. 2162. G. Brown Goode, Washington, D. C.
No. 2163. Lyon G. Tyler, Williamsburg, Va.
No. 2164. James B. Angell, Ann Arbor, Mich.
No. 2165. Henry Hazlehurst, Philadelphia.
No. 2166. David K. Tuttle, Philadelphia.

And the Society was adjourned by the presiding member.

Stated Meeting, November 1, 1889.

Present, 14 members.

Dr. RUSCHENBERGER in the Chair.

Mr. Henry Hazlehurst, a newly elected member, was presented to the Chair and took his seat.

Correspondence was submitted as follows:

Letters accepting membership in the Society were read from

No. 2160, Dr. Walter J. Hoffman, Washington, D. C., October 24, 1889.

No. 2161, Major J. W. Powell, Washington, D. C., October 21, 1889.

No. 2162, George Brown Goode, Washington, D. C., October 22, 1889.

No. 2163, Hon. Lyon G. Tyler, Williamsburgh, Va., October 24, 1889.

No. 2164, Prof. James B. Angell, Ann Arbor, Mich., October 23, 1889.

No. 2165, Henry Hazlehurst, Philadelphia, October 21, 1889.

And No. 2166, David K. Tuttle, Philadelphia, October 22, 1889.

A letter was read from the American Folk-lore Society announcing that its first annual meeting would be held at Philadelphia on November 29 and 30, 1889.

A letter of envoy was received from the U. S. Commission of Fish and Fisheries, Washington, D. C.

Acknowledgments were received from the Asiatic Society (China Branch), Shanghai (126, 127); Comité Geologique, St. Petersburg (128); Dr. Hermann Rollett, Baden-bei-Wien (128); Naturhistorischer Verein, Bonn (128); Kansas Academy of Science, Topeka (127, 128); Don Mariano Barcena, Mexico (128).

Comité Geologique, St. Petersburg; Dr. O. Donner, Helsingfors, Finland; Société R. de Zoologie, Natura artis Magistra, Amsterdam; K. Zoologisch-Botanisch Genootschap, Gravenhage; Fondation de P. Teyler van der Hulst, Harlem; Senckenbergische Naturforschende Gesellschaft, Frankfurt-am-Main; Naturhistorische Gesellschaft, Hanover; Verein für Erdkunde, Metz; R. Biblioteca N. Centrale, Firenze; Mr. Tomasso Cannizzaro, Messina, Italy; Prof. G. Sergi, Rome; Société des Antiquaires de la Morinie, St. Omer, France; Prof. William Crookes, London, Eng.; Prof. James Geikie, Edinburgh; Admiral Edw. Y. McCauley, Dr. David K. Tuttle, Philadelphia (all 129).

Accessions to the Library were announced from the Tokio Library; Prof. G. D. E. Weyer, Kiel; K. Statistische Landes-Amt, Stuttgart; Instituto y Observatorio de Marina de San Fernando; R. Geographical Society, London; Heirs of Dr. James Henry, Dublin; Dr. Charles C. Abbott, Trenton, N. J.; Massachusetts Bureau of Statistics of Labor, Boston; Pennsyl-

vania Geological Survey, Harrisburg; William S. Baker, Henry Phillips, Jr., Dr. Charles A. Oliver, Philadelphia; Johns Hopkins University, Baltimore; National Academy of Sciences, Department of State, U. S. Commission of Fish and Fisheries, A. S. Flint, Gen. M. C. Meigs, Washington, D. C.; Direccion del Goberno del Estado de Michoacán, Morelia, Mex.

The Committee on C. R. Keyes' Paper reported progress and was continued.

The deaths of the following members were announced:

M. Gaston Planté, Paris, May 21, 1889, æt. 55.

Prof. Leo Lesquereux, Columbus, Ohio, October 21, 1889, æt. 83.

Mr. Henry Winsor, Philadelphia, October 29, 1889, æt. 86.

On motion, the President was authorized to appoint suitable persons to prepare the usual obituary notices of Mr. Winsor and Prof. Lesquereux.

Prof. Ryder read a paper entitled "A Physiological Theory of the Calcification of the Skeleton."

Prof. Cope presented a "Geological Survey of the Concho Country, Texas," by Prof. J. W. Cummings and Dr. Otto Lerch.

A communication read from Mr. Burnet Landreth in reference to an Association of Centenary Firms and Corporations of the United States was ordered to be filed.

On motion of Dr. Brinton, the Committee on Finance was requested to consider and report at the next meeting upon the expediency and propriety of the Society's subscribing $50 towards the expenses of receiving and entertaining the Convention of the American Folk-lore Association, about to meet in this city at the University of Pennsylvania, on November 29 and 30, 1889.

Dr. Brinton made the following motion:

Resolved, That the Secretaries be authorized to communicate with the officers of the other scientific societies and libraries in Philadelphia, for the purpose of preparing a Union List of Scientific Periodicals open to the members of all scientific societies by proper introduction.

Dr. Morris moved to amend by striking out all after the word *Periodicals*.

Mr. Horner moved to amend by inserting after *Periodicals* the words "taken by them."

Prof. Heilprin moved to amend by inserting after *Periodicals* the words "including Transactions and Journals."

The amendments were accepted by the original mover, and the resolution, as finally amended, was unanimously adopted as follows:

Resolved, That the Secretaries be authorized to communicate with the officers of the other scientific societies and libraries in Philadelphia, for the purpose of preparing a Union List of Scientific Periodicals, including Transactions and Journals taken by them.

And the Society was adjourned by the presiding member.

The Phylogeny of the Sweat-Glands.

By Prof. John A. Ryder.

(*Read before the American Philosophical Society, October 4, 1889.*)

The suggestion of the descent of the Mammalia through a reptilian ancestry has been favorably received by many naturalists. In this connection, those singular Permian types described by Prof. Cope under the name of *Theromora* may be recalled. The *Theromora* present certain striking resemblances to the monotremes, but what their integuments may have been like in microscopic structure we shall probably never know. And it is just upon this question of integumentary structure that much of high taxonomic importance rests. Upon examining the integument of vertebrates the general plan of structure is found to be very similar in all of the orders. The main differences arise (1) through variations in the thickness of the epiblastic epidermis and the mesoblastic dermis or corium; (2) the arrangement of the connective-tissue fibres of the latter, and (3) the absence or degree of development of glands in connection with the epidermis.

The tendency of the fibres of the corium to interlace in three directions in fishes is marked, and may be best seen in selachians and chondrosteans, while it is equally striking amongst Marsipobranchii. The fibres seem to be disposed in annular layers, between which longitudinal layers are disposed, while the whole is firmly bound to the subcutaneous connective tissues by fibres which traverse the meshes of both the preceding layers, this third

class of fibres having a direction which is vertical to the outer surface of the body.

In the other groups the fibrous layer or corium departs more or less from this primitive arrangement; the type which presents the least departure from the arrangement of the elements of the two integumentary layers of fishes are the Batrachia. Above the Batrachia, the subcutaneous layer begins to show the fibres running irregularly without such an obvious arrangement of laminæ. This is the case in Reptilia, but in Aves, over the feathered areas, there is a tendency for the fibres of the corium to be disposed in coarse quadrangular or lozenge-shaped meshes, the decussations of which correspond to the points of insertion and mode of arrangement of the deeply implanted feathers.

In Mammalia there is the greatest variation in the thickness of the epidermis. In the elephant the epidermis is quite thin, but the corium in the most exposed parts is of enormous thickness and contains a great proportion of elastic fibres, that kind of tissue reaching a most phenomenal development in this form, even invading the adipose and muscular tissue in all parts of the body of the animal.

In the Cetacea and hippopotamus the epidermis is much thickened and the papillæ of the corium greatly elongated. These two forms are amongst those which depart most widely from the usual type characteristic of Mammalia, in that in the first the sudoriferous glands appear to be wanting, and the corium is rudimentary, while in the latter they are modified into the remarkable organs concerned in the secretion of the red exudation, "bloody sweat," which has been noticed by many writers, but which was never adequately studied until examined by Max Weber.*

The development of the glands of the skin, which are always in direct genetic relation with the epidermis, opens up questions of considerable phylogenetic interest, and to call attention to these is the purpose of the present note. If we tabulate the classes of vertebrates according to the degree of development of the dermal glandular organs some singular as well as interesting contrasts are brought out and clear evidence of the method of evolution of these organs is also obtained.

A.—1. The fishes (selachians, teleosts, etc.) tend to develop numerous scattered unicellular glands of the skin, as goblet cells.

These single-celled structures have doubtless multiplied side by side and given rise, first, to a pit, then by further invagination to a flask-shaped glandular appendage of the epidermis, somewhat according to the method suggested by Lang.† In this way the simplest form of epidermal gland, such as is seen in the Batrachia, may be supposed to have arisen.

It is at least suggestive that the persistence of goblet cells in the alimentary tract and bladder of some forms (the bladder being primarily a diverticulum of the intestine) is an inheritance from the gastrulated stage

* Studien über Säugethiere. Ein Beitrag zur Frage nach dem Ursprung der Cetacean. 8vo, Jena, 1886.

† Lehrbuch der Vergleichenden Anatomie, 8vo, Jena, 1888, p. 39, Figs. A, C, D, E.

of metazoan development, seen in the living Cœlenterata, in which the goblet-cell type of epidermal gland first appears. This persistence is due to the persistence of the physical conditions favoring the survival of such a primitive type of gland, the epithelium of the alimentary canal of even the highest types being constantly bathed with fluids, in much the same way as the skins of the lowest aquatic vertebrates and the cœlenterates are constantly in contact with the surrounding water.

2. The marsipobranchs are anomalous. The slime glands or lateral sacks of *Myxine*, with their singular coiled-up bodies, first described by J. Müller, are not of epidermal origin, but lie in or beneath the corium.

The representatives of the goblet cells are the refringent clavate glandular cells so numerous and embedded at various depths in the epidermis of the adult lamprey, with their narrow bases resting upon the corium. In the young lamprey these cells are superficial and rounded, occupying more nearly the position of goblet cells. The inference, therefore, is that the Kolben and Körner-zellen of the epidermis of marsipobranchs have wandered inwards from the surface into the deeper parts of the epidermis, and have been probably derived from what were primarily goblet cells.

B.—1. The Batrachia are characterized throughout by the possession of a remarkably developed system of epidermal glands. The function of these organs in batrachians is doubtless manifold, while their structure is extremely simple, being mere flask-shaped organs over most of the integument, and having a very extensive distribution, extending even over the eyelids, tympanic membrane and under surfaces of the manus and pes. The only departures from the simple flask-shaped type of the skin glands in this group is on the under surface of the pes and manus and in the parotid region of certain salamanders (*Chioglossa*, Wiedersheim). In some of these cases there is a slight tendency for these organs to become racemose; but this is rare and exceptional, just as it is rare and exceptional for the sudoriferous glands of Mammalia to become racemose, those of hippopotamus showing this tendency (Weber).

The function of the epidermal glands of Batrachia is to pour out a whitish, viscid and very acrid secretion. The inner ends of the secretory cells of the walls of the glandular sacks are sharply defined and are seperated by a very distinct outline from the mass of secreted matter contained in the follicle. The method of secretion is therefore not akin to that of the cells of a mucus gland; the nuclei of the secreting cells do not, as in the latter, occupy a quite peripheral position.

The secretion is, however, very mucus-like, as is easily learned upon handling the common frog where the skin is constantly bathed by the secretion. It is known to be also very poisonous if injected into the blood of warm-blooded animals, the secretion being also highly poisonous to other species of batrachians if injected into their vessels, death in all cases resulting in a few hours.

It is also intensely acrid in some if not in all forms; that secreted by

the skin of a living *Hyla carolinensis*, if placed upon the human conjunctiva, produces an intense burning sensation similar to and almost as uncomfortable as that produced by red pepper brought into contact with the same parts. This experiment with the secretion of *Hyla* the writer upon one occasion accidentally inflicted upon himself. The acrid and poisonous properties of the secretion are therefore also probably protective in a high degree to the various forms of Batrachia, which are otherwise but poorly provided with organs of offense and defense.

Another purpose which these glands also subserve is that of keeping the skin constantly moist, in this manner making the integument more efficient as a respiratory organ, such a function of the integument being highly developed in the Salientia.

It is not certain if these organs also serve as an excretory apparatus, but it is highly improbable that an apparatus so highly differentiated as are these epidermal glands of the Batrachia and which secrete so actively and directly to the exterior, should not also be found to serve as emunctories somewhat after the manner of the sudoriferous glands of Mammalia. I therefore regard it as highly probable that they are also excretory in the sense that they share in the process of the discharge of waste matters.

As to their structure the following may be remarked. They are obviously formed in absolute continuity with the epidermis. They lie just beneath the epidermis, or they may be said to be sessile or without any stalk-like duct leading from the saccular portion to the epidermis to the exterior. The canal, however, which passes from the gland through the epidermis has flattened cells differentiated in its walls, so that one may say the efferent duct presents the character of a canal with a wall formed of flattened elongated cells, the whole duct being embedded in the epidermis. At the point where the saccular portion of the gland and its duct join there is evidently a very gradual transition from the cells of the glandular part of the organ to those of its duct. Whether the smooth muscular fibres which run nearly parallel with each other from the point where the gland passes into the duct to the fundus of the latter are derived from the epidermis or not cannot be made out with certainty from the structure of the adult skin. These flattened muscular elements taper towards the duct and converge toward one point at their opposite ends over the inner globular end or fundus of the gland. In teased preparations the relations of these muscular fibres to the gland may be very distinctly seen, reminding one somewhat of the manner in which the curved cycle of staves forming the sides of a barrel are joined together by their edges. There is only one layer of these smooth muscular fibres, though in some cases the edges of two adjacent fibres seem to slightly overlap each other. The very intimate union of the gland, its duct and its muscular investment, and the close union of the whole to the overlying epidermis, indicate very clearly that the mode of origin of the structure is that which has already been described, viz., a simple involution of the epidermis. The only part of this whole structure the epidermal origin of which is in doubt are the

smooth and longitudinally disposed muscular fibres, though it is to be borne in mind that just beneath the closely grouped globular or flask-shaped glands there occurs the outer non-fibrous and granular layer of the corium which contains no cellular elements. This non-nucleated layer is followed by the rather thick fibrous corium, containing connective-tissue cells. This layer of fibrous matter has a horizontal disposition and the included cells are much flattened, and like the fibrous tissue are parallel to the surface. Then follows the second or deepest layer of pigment, and in this latter the principal dermal blood vascular network is embedded. This deeper vascular network, however, joins a much less developed and more superficial vascular network of capillaries, which ramifies just beneath the epidermis, their junction being effected at intervals by means of small vessels, which penetrate the inner fibrous and outer granular layers of the corium. This outer capillary plexus forms a mesh of vessels just below the epidermis. This outer plexus also forms more or less complete plexuses about the globular glands already spoken of. The blood vascular plexus is incomplete over the deeper ends of the glands, but narrow lymph channels and spaces surround them. These lymph spaces are probably continuous with the intercellular spaces between the deeper strata of epidermal cells, and communicate with the larger intercellular lymph passages which are very obvious between many of the cells of the second or penultimate layer; the direct outward communication of these wider intercellular superficial passages seems, in fact, to be shut off by the presence of the outermost layer of epidermal cells, the edges of which are closely joined together. The only remaining elements of the skin to be mentioned is the outermost or superficial layer of pigment cells just beneath the epidermis. The most superficial blood vascular plexus is in close relation to this outer stratum of pigment cells; these frequently extend over the sides of the glands immediately overlying their coat of smooth muscular cells. In densely pigmented regions the pigment cells frequently form a reticulum under the epidermis and over the glands, the processes of the cells loaded with pigment granules blending so as to produce the appearance of a fabric with irregular meshes, this meshwork being depressed at close intervals in the form of a minute reticulate sack into which a gland depends in each instance.

The walls of the glands in sections are composed of clear cubical cells containing a bright nucleus and two or more nucleoli.

This description is drawn from the appearance presented by sections of the skin of the common edible frog of the United States, *Rana catesbiana*, and from the writer's observations upon other forms; the account given applies in general terms to a great many other batrachian forms.

2. The next group (Reptilia) does not possess epidermal glands except in a few instances, over a few very limited areas of the integument. The discussion of their integument in this connection would therefore be of no interest, since the integumentary glands have for the most part been lost or suppressed.

3. In the birds, or Aves, with the exception of the oil gland on the tail, there are no integumentary glands which can be compared with those of the Batrachia.

4. In the Mammalia the case is very different, for in this group we again for the first time encounter epidermal glandular structures which may be legitimately compared with those in the Batrachia. Aside from the modifications which have resulted from the specialization of the different layers of the mammalian integument, the only difference which the sweat glands of the latter present in comparison with the epidermal glands of Batrachia are such as may be ascribed to the farther development or progressive evolution of a type of integumentary gland in all structural respects essentially similar to the skin glands of the last-mentioned group. In the next place, the majority of the Mammalia possess integumentary glands which are scattered over the whole of the body. In this respect the Batrachia and mammals are the only forms which essentially agree in the distribution of their integumentary glandular organs other than the mammary, and a few others found in the latter group. The absolute want of a generally distributed integumentary glandular system in the two great groups of Reptilia and Aves proves that the phyletic history of these two series is very old, and perhaps almost or quite coeval with that of the Mammalia. It is almost equally certain that the three series, Reptilia, Aves and Mammalia, have had a common remote aquatic ancestry, and that the oldest members of that ancestral series had the integuments defended by goblet cells, followed by a succession of forms in which flask-shaped integumentary glandular organs were developed. Are the existing Batrachia representatives of that series which possessed the simple flask-shaped integumentary glands? Were the *Theromora* provided with simple saccular integumentary glands? These are questions still to be answered. From all that we know of the integuments of the primitive types of vertebrates, we may assume, with every assurance of the legitimacy of the deduction, that both Reptilia and Aves have probably lost the integumentary glands corresponding to the sweat glands of Mammalia.

In the Mammalia the sweat glands are characterized by the differentiation of a long tubular efferent duct, which has a slightly spiral direction, which becomes more marked where the outer portion of the duct passes through the stratum corneum of the epidermis. At the other end, the simple tubular and properly glandular portion of the gland usually lies in a close coil invested by a plexus of capillary vessels. Or this deeply-lying glandular portion may not be so closely coiled, but extend as open loops or irregular bends amongst masses of areolar and connective tissue, as may be well seen in the sweat glands of the ball of the foot of the domestic cat, though here, as in other forms, the relation to the blood vessels is the same. In all these cases, however, there is essentially the same structure, namely, a lining secretory epithelium and an investment of longitudinally disposed unstriped muscular fibres, an arrangement which can be compared only with the arrangement of the tissues making up the far simpler integumentary glands of the Batrachia.

If we now turn to the Batrachia in quest of integumentary glands which bear a still greater resemblance to the sudoriferous or sweat glands of Mammalia, we find them on the balls of the toes and integumentary thickenings of the footpads of certain *Salientia*. Integumentary glands with a long duct and a short tubular secretory portion have been described by F. Leydig* from the tips of the digits of Bufo, Pelobates, etc. The structure of these organs, moreover, corresponds exactly to that of a very immature or embryonic sweat gland which has become provided with a duct or has acquired a lumen. They have the same lining of secretory cells in the deeper glandular portion covered by longitudinal muscular fibres. They have already acquired a long non-glandular efferent duct, which is evidently homologous, so far as structural details are concerned, with the efferent ducts of the sweat glands of mammals.

In the light of all the evidence now at our command, the following conclusions seem to me to be warranted:

1. That the integumentary glands of Batrachia and the sweat glands of mammals have had at least a common ancestral origin.

2. The method by which an integumentary gland as simple as that of the Batrachia might become converted into a sudoriferous gland would involve, in the first place, a comparatively slight change of function, and, in the second place, simple elongation in the direction of its own axis and the differentiation of an outer non-secretory portion serving as a duct and a deeper glandular portion. Some of the steps in this process have been alluded to, and it only remains for us to suppose that as a result partly of the great thickening of the epidermis in mammals that the efferent ducts have acquired greater length while the simple tubular glandular portion has simply grown in length and become pressed into a close coil, as its functional importance became greater.

3. That the Theromora may have possessed integumentary glands, seems not unlikely from the fact that they are believed by Prof. Cope to be the most batrachian-like reptiles.

4. It is equally probable that, with the change of habit from that of a water and moisture-loving animal to one of terrestrial habits, the primary form of integumentary gland would undergo important functional changes or adaptations, as great or greater than the change in form of the gland.

5. The principal change in the character of the integumentary glands is in their form. They pass gradually from a rounded globular form in lower types to a more elongate tubular and even much coiled form in the higher types, while preserving essentially the same morphological structure. The writer therefore believes that there is no escape from the conclusion that the comparatively complex sudoriferous glands of higher types have arisen by differentiation from the simpler defensive or poison-secreting, integumentary glands of some lower type in which they closely resembled those of the living Batrachia.

* Ueber den Bau der Zehen bei Batrachiern und die Bedeutung des Fersenknochens. Morph. Jahrb., ii, 1876, pp. 165–196, Pl. viii–xi.

Proofs of the Effects of Habitual Use in the Modification of Animal Organisms.

By Prof. John A. Ryder.

(*Read before the American Philosophical Society, October 18, 1889.*)

Much has been written in regard to the supposed effects of use in inducing more or less permanent and inheritable alterations in the structure of animal forms. Darwin lays stress upon the effects of disuse in weakening the muscles which control the movements of the ears. He supposes, on the ground of disuse, that the drooping ears of the many domesticated races and species of mammals may have thus arisen. He also urges the same argument to account for the poorly developed and almost abortive eyes of moles and certain rodents. To decreased use he attributes the origin of the lighter wing-bones of domesticated races of ducks, while their relatively stronger leg-bones he attributes to increased use. He also supposes that the increased dimensions of the udders of cows and goats are partly to be attributed to the effects of unwonted and more prolonged use when bred from generation to generation for purposes of milking. He also cites approvingly the results of the experiments of Ranke, who showed that the flow of blood is greatly increased towards any part which is performing work, and again sinks or diminishes in amount when the part is at rest, concluding that, if the work is frequently recurrent, the vessels increase in size and the part is better nourished. From the frequent reference to the effects of use and disuse and his evident belief that such effects were inherited, it is clear that Mr. Darwin attached great importance to use and disuse as an agent in modifying species. In so far as Mr. Darwin appealed to the effects of use and disuse he followed the lead and accepted some of the conclusions of his great predecessor, Lamarck, who had published his own views more than fifty years before the appearance of the "Origin of Species."

Lately much activity has been manifested by the German biologists, under the leadership of Prof. Weismann, in testing the effects of the inheritance of mutilations in reference to the question of use and disuse. It is the opinion of the present writer that the method of experimentation resorted to by Weismann is altogether unsatisfactory, since the mutilations in the first place were made upon parts which were not only already rudimentary, but also after the ontogenetic processes had been practically completed. Weismann practiced the excision of the tails of mice in a series of successive generations without any inherited result, and forthwith concludes that mutilations are not inherited. This negative evidence, based on experiments in mutilating mice, is of absolutely no value whatever in solving the problem of the effects of use and disuse now before the present generation of biological investigators, as I hope to show

in the near future. One may be still more sweeping and even offer good reasons for the assertion that there is not now upon record a single instance of structural modification due to mutilation which has been even adequately traced or studied by the help of the rigorously exact ontogenetic method. Experiments in mutilating a few successive generations of mice are of no value in deciding this question, first, partly for the reasons already assigned, and, secondly, because there were not enough successive generations experimented upon, and, thirdly, because there is but little direct evidence to prove that structural alterations resulting through *external* mutilation are inherited. To hold up the results of such experiments as conclusive evidence against what are claimed to be the erroneous views and grounds of opinion of Lamarck and his followers may be regarded as scientific amongst Neo-Darwinists, but as a good old-fashioned Lamarckian such a proceeding appears to me just the reverse.

The evidence as to the effects of use in the modification of species was very meagre in Lamarck's time, and but little evidence of a conclusive character has been accumulated since, as is proved by the paucity of examples cited even by Darwin himself. Even the cases of the dung-beetles, where the tarsi of the anterior legs are completely lost in *Ateuchus*, the sacred beetle, the evidence that their absence is due to the inheritance of their very frequent loss through mutilation is uncertain. The only case where a mutilation seems to have been inherited is, as the writer first pointed out, that of the imperfect enamel crowns of the embryos of white rats studied by Von Brünn. In these cases the imperfection of the enamel coverings in the just erupting molars corresponded exactly to the enamel areas worn off through use at the tips of the crowns in the molars of the adults.

While it is impossible to subscribe to much that has been offered as explanatory of structural modification through use alone, there are many instances of structures the origin of which is to be accounted for in no other way. The crude hypothesis of Herbert Spencer ("Prin. Biology," ii, Chap. xv), as to the method of evolution of the vertebral column, while far better than the transcendental speculations of Owen respecting the general homologies of the vertebral bodies, with their appendages, can now be replaced with a far better one. While it remains true, as Spencer points out, that the segmentation of the vertebral axis is due, as even Rathke and Balfour recognized, to the mechanical requirements of such an axis and the conditions of growth under which it is placed, the details of this process have not even yet been fully worked out. In order to do so the vertebral axis of every distinct type must be critically investigated; the processes of the ontogeny of every one of its elements, no matter how minute, not simply its ontogeny, must be traced before comparisons and deductions are in order. Over a year ago the present writer took up anew the general subject of the vertebral column throughout the vertebrate series, with the result of finding that this structure is an example of continuous evolution as supposed by Herbert Spencer, in his article entitled

"*A Criticism on Prof. Owen's Theory of the Vertebrate Skeleton,*" and published in the *British and Foreign Medico-Chirurgical Review* for October, 1858. I find that it is possible on the basis of fact to completely substantiate, so far as the vertebral column is concerned, Mr. Spencer's conclusion, stated near the close of the article just cited, that: "It is a perfectly tenable supposition that all higher vertebrate forms have arisen by *the superposing of adaptations upon adaptations.*"

I find in fact that not only have the successively higher and higher types of vertebral elements grown out of one another in succession as the consequence of superimposition of new characters, but also that as a result of such superimpositions of new features a complex series of substitutions have resulted, which it is not in place to discuss in detail in this connection. It may be demonstrated that the growth and evolution of the jointed calcified vertebral column, after the development of the notochord was achieved and upon which the first expression of a segmented support was moulded, could take place in only one way, in forms with a free larval stage or such as developed quickly into an active organism, followed by a prolonged period of growth. It may also be proved that the only jointed calcified structure which could here satisfy the requirements of rapid, tridimensional, continuous growth in such a case without entailing inefficiency was the biconcave type of vertebræ, which are thus found to have a profound physiological and adaptive significance which has never hitherto been even dreamt of by the ordinary "*Ding an Sich*" school of morphologists, the offspring of the one-sided training now practiced in all European and American biological laboratories, in which the microscope, microtome and homologies, real or fancied, are the reigning fetishes. It may be shown also that the development of the vertebral bodies under such conditions is exogenous; that the mechanical conditions, definite motions and space relations of the parts involved are the determining factors in the evolution of a definitely-shaped succession of segments moulded upon a preëxisting notochordal rod. It may also be shown that, as layer after layer of new matter is superimposed upon the first trace of a vertebral body, these layers become successively wider and wider, and that the last formed or youngest and most external layers are the only ones which articulate by their edges and form the points of contact of the ends of the cylindrical vertebral bodies. It is thus easy to understand that, with every increment of growth, a new articulation is established between every two successive vertebræ, and that at the same time the innermost and first annular rings of calcified vertebral substance of successive vertebræ are pushed as much farther apart as the new rings at the periphery have grown in additional width. Thus arises that marvelously ingenious yet extremely simple form of calcified vertebral body which not only furnishes the means of continuous growth, but also that of continuous functional activity.

It may also be rendered certain that it is such a biconcave form of vertebral body which forms the basis out of which all the others have

grown. It may be shown that traces of the more primitive biconcave matrix of the vertebral body are embedded within the cartilaginous or even osseous matrix of the later stages as seen in some Batrachia and reptiles. It may also be shown that the epiphyses of the centra of higher types have their cartilaginous bases developed as ingrowing proliferations from the cartilage formed outside of the more primordial calcifying matrix which is broken or interrupted into a regular succession of recurring rings by the flexures of the body induced by the muscles during locomotion. This process of cartilaginous invasion begins to show itself in the very lowest of the true fishes or Lyrifera, viz., *Chimæra*.

There has been not even a partial abandonment of the primordial method of development of the vertebral bodies until we meet with forms which undergo a prolonged and complete development *in ovo* or *in utero*. There has, therefore, been no deviation from the primitive method of evolution of the calcified, flexible, jointed vertebral column until forms are reached in which specialization is so extreme as to require as an absolute physiological necessity an abbreviation of the processes of development of the column. Yet even in the most abbreviated form of development, as seen in Mammalia, including man, unmistakable traces are left over of the once biconcave condition of the vertebral segments. It may be shown that the physiological, histological, chemical, physical and mechanical conditions render the biconcave vertebral body the only one which is possible in the primitive condition; it therefore follows that there was no natural selection possible after the notochord was formed. There was only one groove, so to speak, along which the progressive evolution of the segmented, calcified, vertebral axis of vertebrates could proceed. There was no turning back once the notochord or vertebral matrix had been formed. The advent of the notochord "ordained the becoming," to borrow a phrase from Owen, of the future jointed column, and all the variations of the latter as manifested in species are the mere expressions of adaptive by-play. The same grounds are taken by Geddes in the discussion of the evolution of epigyny through perigyny and hypogyny in flowering plants.

Natural selection has therefore had absolutely nothing to do with the genesis of the primordial type from which all vertebral axes are evolved. At most the action of natural selection must be extremely indirect, and could in no way be operative except through the notochord, which may be shown to be a modified derivative of the intestinal wall of the same histological nature as the cellular axial cords of the tentacles of Hydrozoa and Scyphozoa. If it is possible to exclude natural selection it is also possible in a great measure to exclude the effects of inheritance. If it can be shown that the only thinkable or conceivable method of evolution of a jointed yet calcified and flexible vertebral axis is that actually realized, how is it possible to prove that inheritance even has anything to do with its development beyond providing for the ontogenetic recapitulation of its cellular matrix, the notochord and the arrangement of the muscles in a

series of lateral pairs, capable of effecting only one movement, which is itself the expression of an adjustment which it is impossible to prove first arose in any other way than as the result of obtaining the greatest physical effect in moving the body most efficiently through the water with only one kind of recurring and alternating muscular contractions happening on opposite sides of the body. Just here the natural selectionist jumps to his feet and declares, "There, you have granted all that we claim." But not so fast; wait a moment. It is competent for him to first prove that this simple muscular training does not increase or stimulate the development of muscle through further histological and morphological differentiation and cell-multiplication, and the subsequent inheritance of this acquired complication and increased strength through use. Since there has not yet been offered an iota of conclusive evidence to the contrary, and, since the necessary investigations have not yet been made to disprove my position, I insist upon remaining an absolutely orthodox Lamarckian.

There are still other reasons for taking the above-stated position, which cannot now be referred to except briefly, as they arise from a consideration of the far more intricate and difficult question of sexuality. The greater part of the recent discussions of the significance and origin of sexuality are so transcendental in their character as to promise little of permanent value, since all of the hypotheses yet propounded, with the exception of the two radically different views propounded by Patrick Geddes and myself, overlook the importance and necessity of keeping in sight the general physical doctrine of the conservation of energy. No biologist has yet recognized with sufficient clearness the overwhelming importance of the principle of overnutrition, which was at once the cause of sexuality, the struggle for existence and the direct means of the evolution of all larval forms. Overnutrition, resulting in sexuality, was the means of heaping up potential physiological energy in the egg so as to render larval development and a larval struggle for existence a possibility; and any other view of the origin of all or most larval types has little or no scientific warrant in fact. If, therefore, physiological energy was superimposed upon physiological energy or potentially stored, so to speak, in a germ-cell of exaggerated dimensions, it follows that the mainspring of evolution or its motive force is to be sought in sexuality and not in the Weismannian speculations as to the significance of one or two polar cells or the existence of a hypothetical germ-plasma which amounts in essence only to a restatement of the fact of heredity to which a hypothetical-physical basis is thus assigned. Since it can be proved that larval adaptations have occurred independently and wholly regardless of the attained differentiation of the parent, the fallacy of Weismann's doctrine of the immortality of the germ-plasma must be sufficiently obvious to those who have followed him in the development of his extraordinary errors.

I wish it to be distinctly understood that I do not consider all evolution as mechanical, but I do wish to be understood that the processes of evolution are physical and must ultimately be treated as physical problems.

To the elucidation of some of the grounds upon which hypotheses of mechanical evolution may be founded I have steadily devoted attention since 1877, in the belief, then, as now, that the only hope of the solution of many of the problems presented by the phenomena of adaptation lay in the direction sketched out in my first considerable essay, entitled, "On the Mechanical Genesis of Tooth Forms," published in the latter part of 1878. That essay met with no recognition amongst biologists except at the hands of my distinguished friend, Prof. Cope. In England, a deservedly well-known odontologist dismissed it, in a work on dental anatomy, with a characteristic British sneer and with comments that showed that he had not only not read it, but that he had also utterly failed to understand the grounds upon which my speculations were based. That line of odontological study has since been most profitably followed out in much greater detail by Profs. Cope and Osborn, but there are other and more definite proofs needed. Since the hard parts of animals are moulded by the soft parts, and not *vice versa*, what is now required is some evidence in the first place that hard parts do in reality suffer modification, through the influence of the actions of an animal, and that Lamarck's theory of use proves true, as happens in the case of several thousand species of fishes now living, notwithstanding the objections so glibly urged off-hand by biologists whose special studies unfit them to express an opinion upon this subject.

The cases usually appealed to to prove the modifying effects of use are too complex, and the history of their parts is not always well enough known to afford conclusive evidence. In the series of cases now to be presented this is not the case. The entire history of the parts, directly affected by an exceedingly simple mode of use, is known from their earliest appearance until the completion of growth. The embryological, morphological and physiological sides of the question are therefore adequately represented in a simple case, and all that remains is to trace the kinetic side of the subject, or that involving the expenditure of energy, in order to complete the physical survey of the problem.

I have been aware for upwards of ten years that it is probable that the numerous transverse fractures in the so-called jointed or "soft rays" of fishes had probably arisen as the result of the interaction of the living fish and its surroundings. Only within a very recent period, however, has it been possible for me to find evidence, which I believe to be incontrovertible, in proof of such a conclusion. This evidence serves to demonstrate conclusively that Nature may and does make truly morphogenetic experiments if we will but pursue her clews until she is literally taken in the act of creating new features. As far as I am aware, the case about to be described is the first one that has been recorded that serves as direct proof of the doctrine that the structure of an organism may be altered by the actions of the organism itself.

The proof that the "soft rays" of fishes are normally fractured and more or less completely segmented by the resultant interaction between

the fins when in functional use, and the resistance offered by the surrounding water in which the animal swims, is based upon a single series of facts observed in the tails of young trout from a little less than, to somewhat more than an inch in length. In young trout that have just completed the absorption of their yelk sacks, it is found that the outer rays of the caudal fin are segmented in a direction different from that observed in the median rays, as shown in Fig. 1. This figure shows that the outer or extreme dorsal and ventral rays are fractured obliquely, while the median rays are broken or fractured in an exactly transverse direction. The obliquity of the fractures of the extreme dorsal rays is also exactly the reverse of those of the extreme ventral rays, so that the lines of fracture lie approximately parallel to an imaginary vertical line drawn up and down over the side of the whole fin.

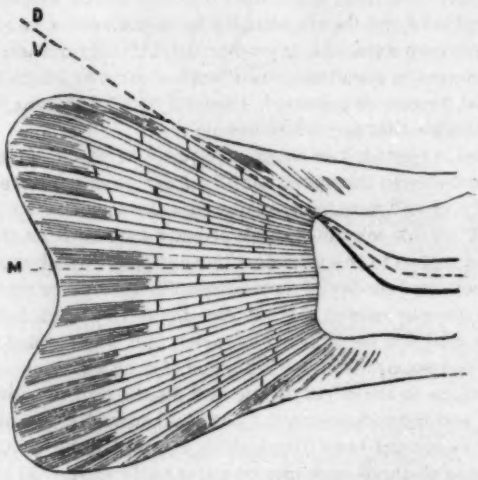

FIG. 1.

Now, what is the significance of these facts? In the first place, that the fractures are real physical breaks which are caused as the consequences of overcoming resistance is shown by the ragged, bruised appearance of the broken ends of the segments, and by the appearance of new breaks between those first formed as the fin-rays become longer and stronger, as the fish grows in size, until as many as two hundred or more may be formed in the course of each of the lateral halves of a single ray. Obviously, the only movements which are effective in bringing the tail into use as an organ of propulsion, are the vibratory movements from side to side, with which every one is familiar who has ever seen a fish swim. In so using the tail the resistance offered by the water is that which must be

offered to a flat vertical membrane supported by rays diverging radially from the hypural bones or cartilages below the upturned urostyle or notochord. Motion is mainly imparted to the caudal fin by the muscles of the urosome, or by that part of the tail of the fish intervening between the base of the caudal fin and the anus. The motion of the caudal fin is therefore controlled by the posterior part of the vertebral column and the lateral muscles of the urosome, and not through the morphological axis represented by a dotted line deflected upward and terminating between the letters D and V, so that the mechanical axis, or the axis which controls the movements of the whole fin, passes out far below the latter along the dotted line ending at M. The consequences are obvious; the resistance offered by the water to the motion of such an osseous framework of diverging rays is such as to break the median ones square across and those slightly below or above the mechanical axis in a slightly oblique direction, while the long rays at the extreme dorsal and ventral margins of the fin are actually broken across at an angle of nearly 45° with their own axis. If any other valid interpretation of the origin of the differences in the direction of the fractures or joints of the fin-rays of the caudal fin can be proposed, I should be glad to hear of them. But it is inconceivable that any other can be true.

While what is regarded as conclusive proof of the modification of hard parts, conformably to the operation of purely physical agencies has been offered above, it still remains to prove that the forms of soft parts are so modified. That this may be done is already evident from the data in my possession in regard to the modifications entailed upon larval stages which undergo specialized modes of development in the egg or reproductive passages of the female parent. If it can be shown that larval stages are structurally modified by physical agencies, it is tantamount to certain that the adult is not exempt from the influence of such agencies. Consequently the old debate as to the effect of use and disuse, and the interpretation of adaptations and inheritance on the basis laid down by Lamarck just eighty years ago; has not yet been disposed of, nor will it be by the fundamentally erroneous methods now almost universally employed by those biological investigators who take the opposite grounds.

In Fig. 2, the heavy curved or wavy lines drawn across the outline of the caudal fin show that the breaks, while practically conforming to a direction parallel to an ideal vertical line drawn across the whole fin, the individual breaks of the separate adjacent rays change position slightly with respect to such a vertical. If lines are now drawn through the transverse rows of breaks of the successive rays we obtain three lines symmetrically related to the mechanical axis of the fin. Three of these lines correspond to the three complete transverse lines of breaks or fractures, while the fourth is not yet complete, but enough of it is shown to prove that when complete it will conform to those in front of it. These major curved lines to which the lines of fracture of all the caudal rays conform, also themselves conform approximately to the outlines of the pro-

files of the successive myotomes, or lateral or muscular segments of the urosome when viewed from the side. These further correspondences and curves are not insignificant. They are undoubtedly to be traced to the

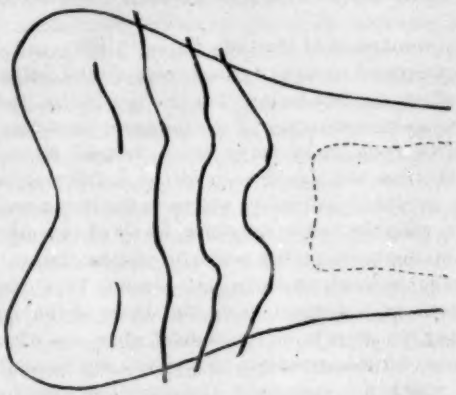

FIG. 2.

properties of strength at different points of the material fractured and the way in which the energy of motion exhibited by the myotomes of the lateral muscles of the tail is exerted upon rays lying at different levels in the caudal fin.

It may be stated that these figures are from actual camera drawings of the objects themselves, and that no liberties whatever have been taken in recording the facts, as permanent preparations in my possession will testify.

A study of the other fins of young fishes discloses the fact that the soft rays in the dorsal, anal, pectorals and ventrals are fractured in conformity with the exigencies of use. A study of the types of orders shows that wherever the "soft rays" occur their transverse fractures are due to the same cause; sometimes even pseudo-arthrodial articulations may thus result. The final conclusion is that the fractures of the "soft rays" of the fins of some six thousand species of fishes now living are the direct results of use. Disuse of the fins would result in absolutely depriving all this host of forms of one of their most salient characters. Whether the effects thus mechanically produced anew in the course of the life of every generation are inherited, is a matter of no consequence, since there is no need in this case for an appeal to the influence of heredity.

A Physiological Theory of the Calcification of the Skeleton.

By Prof. John A. Ryder.

(*Read before the American Philosophical Society, November 1, 1889.*)

The well-known researches of Harting, Rainey (1858), and Ord (1879) on the interference exerted by the physical properties of colloids in modifying the form of crystalline bodies left to crystallize therein, may afford the basis for an interpretation of the processes attending the genesis of the calcareous skeleton in many living forms. Especially is this true if we keep in view the significance of the indifferent intercellular colloids normally produced at certain places in the living organism, and their comparative passivity with reference to all of the metabolic processes going on in the surrounding active or cellular tissues. The substances which, when isolated, as Collagen, Elastin, Chondrigen, Chondrin, etc., represent in a separate form the basis of the non-cellular, passive and supporting structures or skeletal elements which serve as points of attachment for the apparatus of motion, the muscular system. These materials, which are essentially of intercellular origin, represent the colloidal or fibro-laminar matrix of bone and cartilage throughout the vertebrates, in which calcareous matters are thrown down and retained, so as to give more or less firmness or rigidity; or, as a firm jelly, as in the case of cartilage, in which cells are imbedded, a certain rigidity is attained through the molecular stability and cohesion of the structures so formed, as in bars of cartilage, for example.

The one series of features which characterizes these bodies is their intercellular origin, their homogeneity and molecular stability or inactivity. They therefore stand in the most extreme contrast with respect to their physical properties when the latter are compared with the other active, living cellular tissues of the organized bodies in which they are found. While all of the living cells of the organism exhibit an active metabolism, the non-cellular supporting tissues, such as the white fibrous, yellow elastic and cartilaginous, cannot of themselves exhibit anything of the sort, but only through the intermediation of the vascular and other tissues is such metabolism possible. Cartilage is usually not traversed by vessels, and is never richly vascular, though it may give passage to a few widely scattered vessels, as happens in some of the cranial cartilages of the sturgeons. As a rule, the presence of vessels in cartilage carries the implication that they have grown into the cartilage secondarily; myeloplaxes or or other amœbiform cells have eroded the cartilage in advance of the ingrowing vessel. In the highest types of bone development, as met with in mammals, birds, reptiles and Amphibia, this is the way in which the cartilage is removed from the centres of long bones, after it has served its purpose as a matrix upon which the forms of the permanent skeletal elements have been moulded in the form of the firmer and more stable substance which

eventually forms the matrix of the calcified skeleton of the adult. This new matrix, after the hollowing-out process has been accomplished by the agency of the ingrowth of the blood vessels and amœbiform osteoclastic cells into the cartilage, is deposited not only within the bone but also on its outside; at first the amœbiform cells, which now begin to be included within it, as the bone substance grows in thickness, are known as osteoblasts, and are joined together by fine protoplasmic processes and to the lymph and blood spaces which have been eroded by the latter within the bone substance. In this way an elaborate metabolic cycle is established with the blood vascular system in which the fine protoplasmic threads, joining the bone cells into an almost infinitesimally fine reticulum, are the ultimate ramifications, while the system of blood and lymphatic vessels are the gross bonds through which the whole is brought into relation and continuity with the general metabolism of the body.

The ultimate ramifications of the vessels through the adult bony tissue are known as the Haversian canals and the canals of Volkmann. The bony matrix around the former is concentrically laminated, around the latter it is not. In the very young of higher animals, such as a child under a year old, the bony tissue does not exhibit the lamination around the Haversian canals such as it shows in the bones of the adult. This interesting fact is confirmed by the structure of the bones of fishes, in which there may not even be osteoblasts present within a bone at any period of the life of the animal; the bones being in reality nothing but absolutely homogeneous or laminated plates of a matrix which has calcified throughout. The matrix in this case, as in all the others, has been deposited by the action of connective-tissue cells and vessels, and both of these may be observed in the vicinity but lying external to the bone matrix. In other cases an elaborate reticular calcifying matrix is developed within cartilage without the presence of vessels. The most singular type of this is that met with in the vertebral centra of sharks, where the radiating and concentric fibres of the calcifying matrix arise between the cartilage cells which formed the primary or embryonic vertebral body. The radiating fibres, in this case, may be traced as continuations into the fibrous connective tissues investing the vertebral column. This matrix is homogeneous, highly refringent and its origin may be traced in the embryo directly to the *membrana elastica externa* of authors.

The non-vascular character of all the tissues of animals immediately involved in calcification has been thus well established. The only vessels which can be identified as actually perforating as the minutest canals either bone matrix or cartilage are the canaliculi from the lacunæ in which the bone and cartilage cells lie. The comparatively coarse capillaries of the Haversian systems are remnants of the erosive and constructive processes which took place when the bone was built up during ontogeny. They become narrower and more constricted as life advances, and the bones become more solidified. It is therefore obvious that the processes of metabolism are here normally at a very low ebb so far as they affect the

bony tissues proper. The matrix being firm and stable there is no close and continuous union with the vascular system except by way of the network of processes of the so-called osteoblasts or "bone-forming cells," which indirectly form one system with the Haversian systems of blood and lymph vessels in the higher types. In the lower types and in embryos this is not the case ; the bone matrix as a plate or delicate reticulum (vertebræ of sharks) calcifies without even the presence of so-called osteoblasts embedded in its substance. The calcification of the homogeneous concentrically laminated cysts, containing parasitic Trichinæ in infested muscle, the cysts being the result of the defensive action of the connective tissues and vessels against the parasites, is surely proof that calcification is a physical process determined merely by the presence of an ametabolic or stable colloidal matrix, which is capable of taking up calcareous or other earthy salts, the latter losing their crystalline characteristics more or less completely, owing to the physical interference of the colloid in the processes of crystallization.

In young sharks, eight inches long, the lower jaw is instructive in this connection. Cross sections of it show that the calcareous salts have been deposited on the superficial layers of the matrix of Meckel's cartilage as irregular nodules, many of which recall some of Rainey's figures of crystalloids formed in artificially prepared and calcareously saturated colloids. These nodules in the young shark's jaw are, moreover, nearest the surface of the cartilage or nearest the vascular source of calcareous deposit. In developing bone the same holds true. It is in the middle or diaphysial part of the cartilage of a fœtal long bone in which endocartilaginous calcareous deposits are first to be observed, or in the oldest part of the cartilage or that in which the colloidal matrix has had the most time in which to passively take up such materials. Later this calcareous material is again absorbed when the cartilage of the shaft is eroded and destroyed by the ingrowth of the blood-vessels, at the time the formation of the matrix of the true bone is to begin.

Summing up the whole of this evidence, we are fully warranted in drawing the following inferences :

1. That a dense homogeneous, a metabolic or passive colloidal matrix, whether found within or without a living body, will tend to abstract and precipitate within itself, in the form of nodules or granules, any calcareous salts with which it may be mixed or by which it is bathed.

2. That the density of these colloidal matrices greatly increases their avidity for calcareous matters, so as to cause them to very soon become completely saturated with the calcareous salts so as to appear homogeneous, and characterized by a mineral-like brittleness, as in the laminar bones of fishes, without included osteoblasts, or as happens in the case of the dense matrix of the true bone tissues of higher animals.

3. That the firmness and persistency of the bones of higher forms are due to the presence of their matrix of collagen-like material to and through which the calcareous materials are being continually brought by the

blood and lymph vessels of the marrow and periosteum, to be absorbed and carried to all parts of the thick bone substance by the processes of the bone cells or osteoblasts.

4. That the avidity of the absorption of calcareous matter is proportional to the density of the colloidal matrix, and that the gradually increasing brittleness of bone, as age advances, is due to such increasing density of the matrix and its still more enfeebled and less active metabolism.

5. That the feebleness of the metabolism going on in bony tissue or matrices is the main cause, together with their avidity for earthy salts in solution in the fluids of the body, of the rapid calcification of young bones as well as of the persistence of their calcified condition throughout life.

6. There are no such things as "bone cells" or "osteoblasts" in the sense of makers of bone; these cells play an absolutely intermediary rôle in bone formation, since they only give rise to the bone matrix, and form a network in the highest forms of bone by which a bond of union is established throughout its substance, serving for the transmission of calcareous salts from one part to another. The absorption and retention of calcareous matter by bones is a physical process, conditioned by the establishment and circumscription of colloidal or homogeneous stable matrices at definite points in the organism; these loci in turn are determined by the soft parts through inheritance.

7. The soft parts have determined, in the main, the shapes of the hard parts of the endoskeleton, and not *vice versa*, with the exception only of the teeth.

The earliest form of a colloidal non-cellular matrix is found in the umbrella of Medusæ, of both hydrozoan and scyphozoan types. It here confers an elasticity to the umbrella which is sufficient to effect the recoil of its margins when the animal is in motion. In other words, the systole of the umbrella is effected by the marginal radial and circular muscles, its diastole or recoil is due to the elasticity of the mass of elastic more or less colloidal matter interposed between the epiblast or ectoderm and the hypoblast or endoderm. Its function is here not only that of a supporting endoskeleton which gives the umbrella its configuration, but also effects the diastole of the umbrella without involving any extra expenditure of energy through its own metabolism, as must happen in contracting muscle.

This gelatinoid matrix is a secretion of the primary embryonic layers and plays an important rôle in giving form or configuration and a certain rigidity to many larval forms. It is therefore physiologically the oldest of all endoskeletal structures.

The next element of the endoskeleton which is of equally great significance in the elaboration of a theory of the genesis of the vertebrate endoskeleton are the axial cellular cords of the tentacles of many Hydrozoa and Scyphozoa, the oral rods and axial supports of the cirri of Branchiostoma, and the notochord of all vertebrates, ascidians and Hemichordata. Prob-

ably the vesicular connective tissue of mollusks falls into the same category.

The common character of all these types of tissue is the development of cavities in its cells filled with fluid. All, except the last, also seem to have lost the power of storing up plasma, and the plasmic cell walls become thin and the nucleus is either pushed into a parietal position and adherent to or embedded in the cell wall, as in the notochordal tissue, or the nucleus is suspended by plasmic threads running radially from the plasma which invests it to the attenuated wall of the vesicular cell.

A mass or cord of such cellular tissue also possesses certain elastic properties as a result of which it may not only give form but also save the expenditure of energy in the same way as we have already seen in the case of the gelatinous matter of the umbrella of Medusæ. Its elasticity probably serves to automatically straighten out the body in young fishes or those in which the notochord is persistent, and thus saves the expenditure of a great amount of energy through the metabolism of muscle. In fact it is almost absolutely certain that the notochord of embryonic vertebrates has the elastic properties which I ascribe to it, judging from the phenomena exhibited while such embryos are dying under actual observation. It is a truly cellular supporting tissue in contradistinction to the jelly-like matrix which makes up most of the sometimes slightly fibrous substance of the umbrella of Medusæ.

The elastic properties of notochordal and other vesicular supporting tissues do not arise as in the gelatinoid non-cellular supporting matrix from an inherent elastic property such as would be met with in a mass of rubber or a jelly prepared from gelatin, but from the qualities arising from a cord or mass of minute cellular vesicles, with rather firm walls, bound together by intercellular substances and external cuticular and intercellular membranes, investing such an aggregate of hollow cells. Such a mechanical aggregate possesses somewhat the properties of erectile tissue, the qualities of which depend upon turgescence. In the latter case it is temporary vascular turgescence under the control of the nervous system, and consequently involves the expenditure of energy through metabolism, both nervous and muscular, whereas in the former case the permanent erection of the tissue is due to the permanent turgescence of the tensely filled individual cells and calls for apparently no expenditure of energy.

Another property of such vesicular tissues is their passivity or metabolic indifference, which is obvious from simple inspection. This indifference or metabolic passivity is also exhibited *en masse*, since there is invariably a tendency to form more or less homogeneous fibrous or dense cuticular membranes around such masses or cords of cells. This is the expression in the living normal organism of the same phenomenon as the deposition of a cuticular capsule around a sliver or bullet which has penetrated and become permanently embedded in the comparatively indifferent or passive connective tissues of a higher animal, or the deposition of a cuticular laminated capsule around Trichinæ lying between muscular

fibres, or the young trematode which has bored as a Cercaria into the corium of a fish and there become encapsuled.

It will be seen later that these facts have a profound significance as respects the genesis of the endoskeleton met with in many mollusks, ascidians, balanoglossus and vertebrates.

In the vertebrates the first intimations of cartilage are met with in *Branchiostoma* around the notochord, but not as definite bars. The gelatinoid matter for the matrix appears to be present around and between the notochord and the muscle plates and in the epipleural folds, but no definite loose cell aggregations have as yet wandered into it to constitute true cartilage. No true cartilage, in fact, exists in *Branchiostoma*, only the materials and possibilities of it.

In marsipobranchs the neural and hæmal arches are developed around the anterior part of the notochordal axis only, and these elements here present the character of a tissue of cartilage cells embedded in a dense fibrous matrix the origin of which is, however, to be traced to a homogeneous circumnotochordal gelatinoid matrix such as is seen investing the notochord of Branchiostoma.

The next step in advance is made through the chimæroids and sturgeons, in which the cartilaginous arches are developed for nearly or quite the entire length of the notochord. From this point onward the cartilage begins to preponderate around the notochord, and as we rise in the vertebrate scale the neural and hæmal arches, where they abut against the notochord, expand in all directions as flat disks, so as to form a more or less complete investment around the notochord. Eventually in birds and mammals, the cartilage precociously replaces the notochord, and it dwindles or aborts in the embryo so that by the time the latter is hatched or born, traces only of the notochord remain within and between the centra.

The axial intermuscular tissue in the extremities of higher types seems to have given rise, in the same way as above described, to the cartilaginous matrix of the limb-bones. In Branchiostoma traces of continuations of the gelatinoid intermuscular substance is found in the epipleural folds. In the true vertebrates cords of proliferated cells in the axis of the limb (prochondral cells of Strasser), pour out or aggregate to themselves more and more of the primitive intermuscular and intermembranous gelatinoid matrix. Definite bars of cartilage so arise, at first unsegmented, representing the whole of the future osseous merites or segments of the limb. At first not sharply circumscribed, such bars eventually become definitely and sharply outlined and imbedded in a matrix of fibrous connective tissue, which is the perichondrium or germ of the future periosteum, in case future ossification occurs.

With circumscription of the definitely formed bars of cartilage the exudation of a still more dense deposit of homogeneous matter occurs through the instrumentality of the perichondrium. This is invariably thickest at the oldest part, or at the middle, of the shaft or diaphysis of cartilage

representing a long bone. This deposit is at first thickest around the middle of the long bones for the same reason as that already assigned for the early appearance of calcareous deposits in the middle of the diaphysis, viz., the greater age of this region.

In calcified bones of Batrachia, Kastschenko has shown that these first homogeneous deposits contain no bone corpuscles, an observation which I have confirmed, while Kölliker has lately recorded similar facts regarding the bones of very young Mammalia, while my own studies in fishes show that there are forms, such as the Lyomeri, which reach even the adult stage without including a single osteoblast in any of their calcified bones. I may further add that embryonic membrane bones of Mammalia, and especially of fishes, at first develop and calcify in the form of absolutely homogeneous plates or in reticuli of a dense homogeneous substance allied to collagen.

Summarizing these results still further, it may be said that:

1. The indifferent intercellular colloid or gelatinoid tissues of invertebrates and vertebrates have a labor-saving as well as a supporting function.

2. The same may be said of the indifferent or ametabolic vesicular and notochordal tissues of invertebrates and vertebrates.

3. The indifferent, ametabolic or passive qualities of both these kinds of tissues apparently leads to the throwing down of homogeneous cuticular deposits upon their surfaces by the surrounding tissues, in much the same way as indifferent foreign bodies are encapsuled by colloid laminated membranes, and which may become infiltrated with calcareous matter.

4. Osseous or calcareous infiltration of gelatinoid or colloid matrices, and of homogeneous reticuli or membranes, always begins in the oldest parts of the same, in conformity with what would be expected of them on *a priori* grounds and in view of their ametabolic physical properties.

A homogeneous membrane of collagen may give rise by intercellular extension and deposit to a reticulum consisting of the same substance. This happens in the vertebræ of sharks, where such a reticulum invades in an outward direction the investing rings of cartilage forming the bodies of the vertebræ and calcifies directly without the intermediation of the invasive or irruptive processes which accompany the formation of the cancellous tissue of the bones of many vertebrates, including Teleosts, Batrachia, Reptilia, Aves, Mammalia.

The cartilaginous tube investing the notochord in sharks has probably been evolved through a condition which is permanent in *Chimæra*, where the cartilage at the bases of the neural and hæmal arches has begun to irrupt through the outer membrana elastica externa into the here enormously thickened fibrous membrana elastica interna. In Teleosts the elastic sheath in many cases seems to calcify and segment directly into the vertebral rings. In other forms the elastica externa is the first to calcify, even long before the cartilage of the vertebral centra. The elastica externa is rudimentary in Aves, Reptilia and Mammalia, and can be seen

only in the embryo with fine processes sometimes extending in cross sections a little distance into the here more developed hyaline matrix of the massive cartilaginous investment.

When the irruptive processes of bone formation or neoplastic ossification occur they are followed by the deposition of dense homogeneous or fibrous matrices around the marrow cavities so formed, within the original homogeneous calcareous tube, which was formed by moulding a deposit of collagen-like substance upon a matrix of cartilage. In such new homogeneous deposits new infiltrations of calcareous matter occur within and superimposed upon the old. In such endosteal deposits and in the later periosteal deposits the homogeneity of the bone substance is interrupted only by the intercalation of the osteoblasts which are left imbedded in the homogeneous matrix as the latter is laid down, layer after layer.

If time permitted, the mechanical advantages and expedients of neoplastic bone formation, as well as the intricate series of substitutions which can be traced in the evolution of the vertebrate skeleton, might be discussed in full, but my intention has been fully realized, at present, if it has been made clear that the physical, chemical and physiological properties as well as the mechanical space relations of the parts involved, must be considered in order to arrive at a sound theory of the origin of the skeleton. It is especially to be insisted upon that the physical properties of the substances involved in calcification are to be taken into account quite as much as their morphological characters, in working out a general theory of the history of the skeleton. Morphology may serve to aid in interpreting phylogenies, but it is evident from what has preceded, that morphology alone is incapable of grappling with the question of the true causes of the genesis of the skeleton, quite as much so as the overstrained hypothesis of natural selection.

NOTE.—The only portion of the skeleton of vertebrates, the matrix of which is of exoskeletal origin, is the enamel. The dentine is endoskeletal.

The elastic fibres found by Kölliker in bone, belong to the category of substances denominated colloidal. The later fibrous character of the matrix of many if not the majority of bones of higher types, as a result of which, while living and moist they have a certain elasticity, does not any the less exclude their constituent fibres from the group of colloidal substances. In the same way the homogeneous actinotrichia of the fins of fishes and their investing matrix of calcified matter is colloidal. The precipitation of calcareous matter follows these actinotrichia to the very margin of the fin folds, where they diverge more and more like the ribs of a fan, and thus give rise to the characteristic dichotomous character of the soft rays of all malacopterygian forms of fishes.

The deposition within the middle of the notochord of an axial median cord of fibrous collagen-like substance is a further instance of the slow degeneration and metabolism which may go on within even a relatively indifferent tissue. This axial cord is an intercellular deposit, and has been

frequently mistaken by anatomists for the whole of the notochord, in the intervertebral regions of the column. It is present in *Chimæra, Acipenser, Petromyzon, Myxine,* and traces of it are present in higher types. It may be derived from the primitive central canal of the notochord, or mark the point from whence that canal has disappeared. The partially tubular notochord of Hemichorda would countenance this view as well as the partially hollow notochord (at the caudal region) of the embryos of some birds.

The writer would here acknowledge the value and importance to him of materials kindly supplied to him from the National Museum at the instance of the obliging Director of that institution, Dr. G. Brown Goode.

On the Genus Nyctinomus and Description of Two New Species.

By Harrison Allen.

(*Read before the American Philosophical Society, October 4, 1889.*)

The genus Nyctinomus includes twenty-one species and is of cosmopolitan distribution. Thus ten species are found in Africa and Madagascar; one in Europe with a range in the northern part of Africa; two in India; two in the Malay Archipelago; one each in Polynesia and Australia, and four in America. It is interesting to contrast this wide range with that of the other two genera of the group in which Nyctinomus is found, namely Cheiromeles, which is restricted to the Indo-Malayan subregion, and Molossus, which is confined to tropical and subtropical America, excluding the United States. Nothwithstanding the extended range of Nyctinomus, the species are closely related. With the exception of *N. johonensis* and *N. australis,* few specialized structures are met with; and but two species—one from Madagascar (*N. albiventer*) and a second from Africa (*N. acetabulosus*)—depart from a single formula for the teeth. As is the case with the Cheiroptera generally, the American species are the most obscure. Of the four described species, I have seen *N. brasiliensis, N. macrotis* and *N. gracilis.* A recent study of the materials at hand has led me to record descriptions of two new species.

Nyctinomus europs, n. s.

Muzzle divided in middle into two parts by a vertical linear groove, the sides of which are defined by spines. These are continuous with the spines of the upper border of the muzzle. Ears united over the face for a

distance of 2 mm. The outer border of the auricle not scalloped on the line of the external basal ridge, but is uniformly rounded. The revolute margin reaches as far as the anterior border of this ridge. The inner border of the auricle retains six small marginal spines. The tragus is small pointed, or obscurely notched on the summit, and is but ½ mm. high. The antitragus, as wide as high, much narrower above than at base; the notch posterior to it is well defined and reaches half way to the base. The external basal ridge is rudimental. The keel is not highly developed and measures 7 mm. in length. The first and fifth toes are thicker than in *N. brasiliensis*.

The tip of the third phalanx of the fourth finger is without projecting lobe.

The lips and adjacent surfaces are more tumid than in *N. brasiliensis*. The postmental wart is especially conspicuous as compared to the same structure in that species. As in *N. brasiliensis*, a medium ridge lies between the wart and the lower lip.

Measurements of Head and Ears.

	mm.
Distance from interauricular membrane to end of muzzle	3
Height of auricle	13
Distance of auricle to angle of mouth	2
Width and height of antitragus	3

In the entopatagium* the intercosto-humeral nerve divides into two terminal branches at the upper third of the wing membrane before reaching the elbow.

Four oblique lines in the positions of the intercostal nerves can be discerned.

The mesopatagium with the internal cutaneous nerves much the same as in *N. brasiliensis;* but the superior branches are much less numerous than in that species. The distal end of the second phalanx of the fifth finger is spatulate.

The nerves on the interspaces the same as in *N. brasiliensis*. First oblique band at radio-carpal angle attached at side of palmar surface of the muscle mass of the fifth metacarpal bone and passes downward and inward at an angle to the radius for a distance of 4 mm. The pouch is conspicuous.

The tendon of the palmar interosseous muscle extends from the middle of the fifth metacarpal bone to the distal end of the first phalanx.

Fur on the back of a delicate fawn inclining to brown at the shoulders.

* For explanation of the terms endopatagium, and mesopatagium, see Proc. Acad. of Nat. Sci., Philadelphia, 1889, p. 314.

The back of the neck and head of a lighter shade. Back of the ear the hair is almost white and covers the posterior surface to a point just beyond the line answering to the keel. The fur of the venter is of a uniform light brown hue, verging to white. The wing membranes and tail membrane are of a brown color and are naked, excepting along a line continuous on the dorsum from the shoulder to the middle of the thigh. A delicate line of fur extends from the upper third of the arm to the middle of the thigh. The fur of the trunk both at the shoulder and thigh is continuous with this line, but on the entopatagium the hair is absent alongside of the body.

On the venter the foot and the distal third of the tibia are the only parts seen of the lower extremity, the remaining parts are concealed by a fold of skin which extends from the pubis to the lower third of the tibia.

The tail membrane with distinct pelvo-tibial line, but without the line from knee which is seen in *N. brasiliensis*. The free margin of the membrane without the lobe which is so well seen in the species last named.

The Cranium.—The superior angle of the occiput is more acute than in *N. brasiliensis* and smaller by one-half. The temporal crest is distinct throughout its entire length. In *N. brasiliensis* it is absent except at the anterior half. The dorsum of the face is without the groove so characteristic of *N. brasiliensis*. The anterior nasal aperture is ovate, not cordate, as in the species last named. The lachrymal process is conspicuous and trenchant. The zygomata are of uniform width. The mentum is recedent; the posterior border being on a line which extends between the second premolar and the first molar. The coronoid process is scarcely higher than condyloid; the angular process projects well back of the condyloid.

Measurements.	*N. europs.*	*N. brasiliensis.*
	mm.	mm.
Length	16	17
Width between zygomata posteriorly	9	10
Width of cranium at narrowest part	3	4
Distance from anterior edge second premolar to end of face	2½	1½

The Teeth.—

$$\text{Inc.}\ \frac{1-1}{2-2},\ \text{c.}\ \frac{1-1}{1-1},\ \text{pm.}\ \frac{2-2}{2-2},\ \text{m.}\ \frac{3-3}{3-3}.$$

Upper incisors near together their entire length. Interval between them much less than in *N. brasiliensis*. First premolar lies to outer side of the postero-basal cingule of the canine, which almost touches the second premolar. In *N. brasiliensis* the first premolar is in line with the cingule. This distinction is associated with a shortening of the axis of the face from the centre of the incisorial space to the first premolar.

Lower incisors equal, bilobed, not crowded.

Measurements of Body.

	mm.				
Length of head and body	53				
" " tail in membrane	17				
" " " free	19				
" " forearm	40				
" " first finger, including metacarpal	8				
" " second metacarpal	39	mm.		mm.	
" " third "	40;	1st ph.,	19;	2d ph.,	15
" " fourth "	40;	"	15;	"	3
" " fifth "	23;	"	13;	"	3
" " tibia	11				
" " foot	7				

The description is based upon examination of twenty adult specimens, all females.

Habitat, Brazil. Collected by Prof. Harte. Prof. B. G. Wilder has kindly permitted me to study the Cheiroptera in the museum of Cornell University. The species above named was secured from this collection, where the type specimens remain.

N. europs resembles *N. megalotis** in the shape of ears and color of fur. It differs in the shape of the antitragus. *N. megalotis* is a larger form, the length of the body and head being 75 mm. (3″), and that of the forearm 56 mm. (2.35″), yet the length of the second phalanx of the fourth finger is less than 1 mm. (0″.1). This phalanx in *N. europs* measures 3 mm.

NYCTINOMUS ORTHOTIS, n. s.

The upper margin of the muzzle is below the plane of the dorsum of the face. The vertical ridge between the nostrils seen in *N. europs* and *N. brasiliensis* is absent. The nostrils are elliptical, slightly expanded above and look directly forward. The entire region of the muzzle abruptly cut off, and of quite peculiar physiognomy. There is no concavity in front of the ears. The upper border of the muzzle is not projecting, and without pectinate spines, but furnished with papillæ, which extend over the nostrils. The ears are erect, large, extending 4 mm. in advance of the muzzle, and are united on the dorsum of the face by a band 3 mm. high.

The general form of each ear is rounded and stands out from the head as in *N. brasiliensis*. No spines occur on the upper border. The outer border is furnished with a lap or hem of skin, which measures one-fifth of the diameter of the ear couch. It is slightly scalloped in the middle and extends as far forward as the end of the external basal ridge. The keel does not reach the antitragus; it is thickened and not revolute. The anterior basal ridge forms a distinct projection at the notch. The notch

* Dobson, Cat. Cheiropt., Br. Mus., 1878, p. 434.

extends to the base of the antitragus. The antitragus is thin, broader than high and slightly higher posteriorly than anteriorly. A skin fold extends from the antitragus to the angle of the mouth. The tragus is quadrate and bears a general resemblance to that in *N. brasiliensis*. The sides of the face are without folds.

The fur on the dorsum is fawn color with paler tints at the base. It extends half way up the ears. On the dorsum the proximal half of the arm, the endopatagium near the body, and the basal fourth of the tail are covered with hair. On the venter the color is the same as on the back, except on the face and ears, where it is of a dark chestnut. The venter, the arm, the thigh and entopagium half way to the elbow are covered with a thin layer of fur. The face is occupied by a number of stout bristles between the ears and the muzzle. Two hairs, 1 mm. long, project from the mental wart.

The following notes have been made on the terminal digits. That of the third digit of the third finger is little over 5 mm. in length, is slightly curved toward the trunk at the tip. A thin membrane is seen at the distal half at the thumb side. The wing membrane extends to the tip toward the trunk.

The terminal digit of the fourth finger is 3 mm. long. The membrane is not attached to the somad surface; while on the pollicad surface it is attached the entire length of the digit. The phalanx is markedly deflected on the free margin of the membrane and ends in a free lobe.

The terminal phalanx of the fifth finger is slightly curved somad. It is 3 mm. long, and nearly 1 mm. wide at base. The membrane is attached to the second phalanx at the middle of the pollicad margin, but reaches to the tip of the phalanx on the somad side.

No entopatagial lines are seen. The internal cutaneous line exhibits a superior branch. The nerve ends abruptly by inferior vertical branches as in *N. brasiliensis*. A line is seen on the interfemoral membrane extending from the middle of the thigh to the free margin of the membrane.

Cranium.—The cranium is of the type of *N. macrotis*. The facial region is high, the nasal bones at the anterior nasal aperture being the highest point of the vertex. The upper border of the aperture is defined by a transverse line, which forms a right angle with the lateral border. A line drawn downward from the border intersects the infraorbital foramen at its posterior limit. The zygoma is without elevation. The ethmoidal swelling (by which term is meant the swelling, in the orbito-temporal fossa, of the frontal bone over the ethmoid) is rounded. The palatal rugæ opposite the molars abruptly angulated, the angle being forwards.

In contrast to the above, the skull of *N. macrotis* presents the following: The facial region at the anterior nasal aperture is the lowest part of the vertex. The upper border of the aperture is Λ-shaped. A line produced downward lies in front of the infraorbital foramen. The zygoma with posterior elevation. The ethmoidal swelling is ridge-like.

The palatal rugæ opposite molars not angulated, but slightly curved, the curve being forwards.

Dental formula the same as in the preceding species.

The first maxillary premolar in *N. orthotis* is in the outer angle between the second premolar and the canine. It is smaller than in *N. macrotis*. The postero-internal cusp of the first and second maxillary molars continuous with a single crescentic cingulum. The cingulum of the third molar of the same series of a single crescentic form. Mandibular incisors four. The first mandibular premolar touches canine.

In *N. macrotis*, the first maxillary premolar is in dental arch, *i.e.*, is neither in outer or inner angle formed by the crowding of the canine tooth and the first premolar, but is in the axis of the dental series. The postero-internal cusp of the first and second maxillary molars separate from the double crescent form of the cingulum. The cingulum of the third molar of the same series of a double crescentic form.

Measurements.

	mm.				
Length of head and body	68				
Height of ear	20				
Length of forearm	57				
" " thumb	5				
" " 2d metacarpal bone	22	mm.		mm.	
" " 3d " "	25	1st ph.,	10	2d ph.,	9
" " 4th " "	24	"	10	"	4
" " 5th " "	12	"	9	"	3
" " tibia	20				
" " foot	7				
" " tail in membrane	25				
" " tail free	9				

Habitat, Jamaica. The single specimen is a skin in the collection of the National Museum (No. 9397, W. T. March), and was received from Spanishtown.

I have been minute in the description of these new forms for the reason that diagnoses of species have hitherto been too general. Some of the characters, such as the shapes of the terminal phalanges, the patterns of the wing membranes, the depth of the notch in the auricle and the point of termination of the auricular flange or hem have not been used in studying Cheiroptera. Even if the attempt to establish new characters should fail, it is of interest to record these novel details of structure.

Stated Meeting, November 15, 1889.

Present, 10 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

From the Naturforschende Gesellschaft zu Emden, Hanover, an invitation to the celebration of the seventy-fifth anniversary of its foundation, December 29, 1889, to which the Secretaries were directed to make a suitable reply.

A photograph for the Society's album was received from Mr. George Harding, Philadelphia.

Letters of envoy were received from the Mines Department, Wellington, New Zealand; Musée Guimet, Paris, France; Literary and Philosophical Society, Manchester, Eng.; Theological Seminary, Andover, Mass.; Department of State, Washington, D. C.

Letters of acknowledgment from the Geological Society of London (127, 128, and Transactions, xvi, 2); Bureau of Statistics of Labor, Boston, Mass. (96–129, Catalog, Parts i–iv).

Letters of acknowledgment for 129 from the Geographical Society, St. Petersburg, Russia; Biblioteca N. V. E., Rome, Italy; K. Sächsische Gesellschaft der Wissenschaften, Leipzig, Saxony; Dr. John Evans, London, Eng.; and from the Tokyo Library, Japan, for 96–129, and Catalog.

The U. S. Department of Agriculture and the Nova Scotia Institute of Science were placed on the exchange list to receive Proceedings from No. 97.

Accessions to the Library were reported from the Royal Society of Victoria; Department of Mines, Melbourne; Académie de la Rochelle, France; Société d'Agriculture, Histoire Naturelle et Arts Utiles, Lyon; Société de l'Histoire de France, Redaction "Cosmos," Société de Médecine Pratique, Paris; Société des Antiquaires de la Morinie, St. Omer; Geological and Natural History Survey of Canada, Montreal;

Theological Seminary, Andover, Mass.; Dr. J. S. Newberry, New York; Dr. D. Jayne & Son, Mr. Henry Phillips, Jr., Misses Phillips, Philadelphia; U. S. Naval Observatory, Washington, D. C.; Free Public Library, San Francisco, Cal.

The Special Committee on C. R. Keyes' Paper reported progress, and was continued.

The President reported the appointment of Prof. Lesley to prepare the obituary notice of the late Leo Lesquereux, and that the same had been accepted.

The suggestions of the Board of Officers and Council were taken up and considered. On motion the Society requested the Park Commission to label the trees planted from the Michaux funds in such a way as will give their botanical and common names, the label to include the legend "From the Michaux Legacy;" and further requested the Park Commission to change the name of "Agricultural avenue to Michaux avenue."

New nominations 1194–1202 were read.

On report of the Committee on Finance, the Society appropriated $50 towards the expenses attending the reception and entertainment of the American Folk-lore Association.

The Committee on the Michaux Legacy presented the following report:

To the American Philosophical Society:

The Michaux Committee respectfully reports, that at a meeting of the committee held on Monday, November 4, 1889, letters were received from Prof. J. T. Rothrock, stating that he had made preparations for the usual annual course of lectures to be delivered under the auspices of the Society in the hall of the Academy of Natural Sciences, Nineteenth and Race streets, on the Wednesday evenings of December 4, 11, 18, 1889, and January 8, 15, 22, 29, 1890. The following will be the subjects of his lectures:

1. Civilization as related to Surroundings.
2. Some neglected Trees.
3. Some famous Trees.
4. Trees along our Roadsides.
5. Trees in our Yards.
6. Trees we are Exterminating.
7. Practical Forestry.

All of these lectures, except the last one, will be illustrated by stereopticon views.

The suggestion of Prof. Rothrock met with the full approval of the committee, and it recommends the expenditure of $264 from the appropriation of the Michaux fund, as follows:

Lecturer	$140 00
Hall	14 00
Exhibitor, gas	60 00
Advertising	50 00
	$264 00

By order of the committee.

J. SERGEANT PRICE,
Secretary.

On motion, it was resolved that the report of the committee be accepted and the sum of $264 be expended from the amount of the appropriation of the Michaux fund, as requested by it.

And the Society was adjourned by the President.

NOVEMBER 21, 1889, on this day, being the one hundreth anniversary of the Society's first meeting in its present Hall, a celebration of the event took place by an address at 4 P. M., in the Hall of the Society, by Hon. Frederick Fraley, LL.D., the President of the Society, and by a dinner at the Hotel Stratford at 6 P. M. A full report of the proceedings and addresses will be issued in Proceedings, No. 131.

Stated Meeting, December 6, 1889.

Present, 24 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Messrs. Andrew A. Blair, Clarence H. Clark and David K. Tuttle, lately elected members, were presented to the Chair and took their seats.

Correspondence was submitted as follows:

A letter from the President of the Society announcing that he had appointed Dr. Charles S. Wurts a member of the Committee on Finance *vice* Mr. Henry Winsor, deceased, and the action of the President was approved.

A letter from Dr. George Inman Riché, of Philadelphia, tendering his resignation from membership in the Society, which, on motion, was accepted.

A letter from B. A. Stephens, Los Angeles, Cal., in relation to a National Convention of Historical Societies, proposed to be held in Philadelphia on July 4, 1890, was referred to the Secretaries with power to act.

Letters of envoy were received from the Mining Department, Melbourne, Victoria; Société Impériale des Naturalistes, Moscow, Russia; Verein für Erdkunde, Dresden; R. Istituto di Studi Superiori, Florence, Italy; Royal Statistical Society, London; Boston Society of Natural History; U. S. Coast and Geodetic Survey, Washington, D.C.

Letters of acknowledgment (128) were received from the Royal Geographical Society, St. Petersburg; Mr. Samuel Davenport, Adelaide, Australia; Boston Society of Natural History.

Letters of acknowledgment (129) were received from the China Branch, Royal Asiatic Society, Shanghai; Geological Survey, Calcutta, India; Observatoire Astronomique et Physique, Tashkent, Russia; "Le Cosmos," Marquis de Nadaillac, Prof. Rémi Siméon, Paris; Maine Historical Society, Portland; Boston Society of Natural History; Academy of Natural Sciences, Davenport, Ia.

Accessions to the Library were announced from the Royal Society of Tasmania, Hobart; Mr. H. Y. L. Brown, Adelaide, Australia; Société Finnoise d'Archælogie, Helsingfors; Société Impériale des Naturalistes, Moscow, Russia; Magyar Tudomànyos Akademia, Budapest; Verein für Erdkunde, Dresden; Verein für Thüringische Geschichte, Jena; Publishers of the "Interpretor," Leipzig; Verein für Naturkunde, Offenbach a. M.; R. Istuto di Studi Superiori, Florence, Italy; Accademia di Scienze Morale et Politiche, Naples, Italy; Nova Scotian Institute of Natural Science, Halifax; American Philological Association, Dr. F. B. Stephenson, Boston; Rhode Island Historical Society, Providence; New York Forest Commission, Troy; Prof. Henry F. Osborne, Princeton, N.

J.; Messrs. W. S. Baker, Henry Phillips, Jr., Philadelphia; U. S. Department of Agriculture, U. S. Geological Survey, U. S. Coast and Geodetic Survey, Washington, D. C.; Ohio Agricultural Station, Columbus.

Donations to the Cabinet were received as follows:

A photograph of the Shingwauk Home for Indian Children, Sault Ste. Marie, Canada, from Rev. E. F. Wilson, Canada.

An engraving of the rear of the State House, Philadelphia, designed and published by W. Birch, 1800, from Mr. William S. Baker, Philadelphia.

The Committee on C. R. Keyes' Paper reported unfavorably upon the same, and the report being accepted the Committee was discharged.

The death of Rev. Joseph A. Murray, D.D., Carlisle, Pa., on November 27, 1889 (b. October 2, 1815), was announced.

The annual report of the Treasurer was presented and referred to the Committee on Finance.

The annual report of the Committee on Publication was presented.

The first annual report of the Committee on the Henry M. Phillips' Prize Essay Fund was presented.

A paper entitled "On a New Species of Carollia, with Remarks on *Carollia brevicauda*," by Dr. Harrison Allen, was read.

Mr. Phillips presented a second list of lacunæ in the Library of the Society.

Pending nominations 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201 and 1202 were read.

The Committee on the Centennial Celebration reported, and was discharged.

On motion the President was authorized to take such action as should to him seem best, upon the subject of a communication to be addressed to the Secretary of War relating to Prof. Haupt's System of Harbor Improvements.

And the Society was adjourned by the presiding member.

Stated Meeting, December 20, 1889.

Present, 24 members.

President, Mr. FRALEY, in the Chair.

Dr. C. E. Sajous, a lately elected member, was presented to the Chair, and took his seat.

Correspondence was submitted as follows:

An invitation to be present at the opening of the Public Library of Minneapolis, on December 16, 1889.

A request from the K. Leopold-Carol, Akademie, Halle a S., for Proceedings No. 109, which was granted.

A letter from Dr. Rothrock, enclosing one from the Museum d'Histoire Naturelle, Section Botanique, Paris, returning thanks to the Society for the photographs presented from the Michaux fund.

Letters of envoy were received from the State Geological Survey, Columbus, Ohio; Kansas Historical Society, Topeka.

Letters of acknowledgment were received from the Société des Naturalistes, Kief, Russia (128, 129); Prof. J. S. Steenstrup, Copenhagen, Denmark (129); K. K. Naturhistorisches Hof-Museum, Vienna, Austria (129); Physiologische Gesellschaft, Berlin (129); Verein für Erdkunde, Halle a. S. (129); Dr. Julius Platzmann, Leipzig (129); Société des Sciences Naturelles et Archéologiques de la Creuse, Gueret, France (129); Musée Guimet, Paris (129); Cav. Damiano Muoni Milan (129); Marquis Antonio De Gregorio, Palermo, Sicily (127, 128, 129); University of Illinois, Champaign, Illinois (129); Bishop Crescencio Carrillo, Merida, Yucatan.

Accessions to the Library were announced from the Nederlandsche Botanische Vereeniging, Nijmeguen; Statistika Central Byran, Stockholm, Sweden; K. K. Naturhistorisches Hof-Museum, Vienna, Austria; K. Gesellschaft der Wissenschaften, Göttingen, Prussia; Verein für Erdkunde, Stettin, Prussia; Mr. L. M. Billia, Milan, Italy; Rev. Edward F. Wilson, Sault Ste. Marie, Canada; Massachusetts Historical Society, Boston;

Mr. Isaac C. Martindale, Camden, N. J.; Semi-centennial Committee of the Central High School, Engineers' Club, Schuylkill Fishing Company of the State-in-Schuylkill, Messrs. E. D. Cope, Lewis M. Haupt, Henry Phillips, Jr., Philadelphia; Johns Hopkins University, Baltimore, Md.; U. S. National Museum, Washington, D. C.; Geological Survey of Ohio, Columbus; Kansas Historical Society, Topeka; Mr. Rafael M. Merchan, Bogota, S. A.

The deaths of the following members were announced:

Henry S. Frieze, Ann Arbor, Mich., December 7, 1889 (b. September 15, 1817).

Franklin B. Gowen, Philadelphia, December 14, 1889 (b. February 9, 1836).

On motion, the President was authorized, at his discretion, to appoint suitable persons to prepare the usual obituary notices of the deceased.

This being the evening for balloting for candidates for membership in the Society, pending nominations Nos. 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201 and 1202 were spoken to and voted upon.

New nominations Nos. 1203, 1204 and 1205 were read.

The report of the Finance Committee was presented, and the appropriations for the succeeding year were passed.

The President reported that he had caused to be engrossed a letter to the Secretary of War* in reference to Prof. Haupt's invention, and that he intended to sign and send it to-morrow.

After all the business of the meeting was concluded, the ballot box was opened and the votes counted, and the result of the poll having been announced to the President, he declared the following-named persons to have been duly elected members of the Society:

No. 2167. Dr. Friederich S. Krauss, Vienna.

No. 2168. Sir George G. Stokes, President of the Royal Society of London.

No. 2169. Rt. Rev. John J. Keane, Rector of the Catholic University, Washington, D. C.

* See Minutes, December 6, 1889.

No. 2170. Dr. Charles C. Abbott, Trenton, N. J.

No. 2171. Dr. George Friebis, Philadelphia.

No. 2172. Dr. Fernando Cruz, Minister of Guatemala, Washington, D. C.

No. 2173. A. Sydney Biddle, Professor of Law in the University of Pennsylvania, Philadelphia.

No. 2174. J. M. Le Moine, President of the Historical and Literary Society of Quebec, Canada.

And the Society was adjourned by the President.

LIST OF DEFICIENCIES

IN THE

Library of the American Philosophical Society.

PART SECOND.

(*Read before the American Philosophical Society, December 6, 1889.*)

PUBLICATIONS OF SOCIETIES CONTINUED.*

EUROPE.

AUSTRIA.

Böhmische Gesellschaft der Wissenschaften, Prag.
Abhandlungen, all before 1875 to VII Folge 1886.
Sitzungsbericht, all before 1886.
Jahresbericht, all before 1886.

Naturforschende Verein, Brünn.
Verhandlungen, all before XXIV Band, 1885.

Meteorologische Commission, Brünn.
Bericht, all before IV, 1886.

Anthropologische Gesellschaft, Vienna.
Mittheilungen, Band I, 1870, all after No. 14 if any, and Title-page and Index.

K.K. Geologische Reichsanstalt, Vienna.
Abhandlungen :
Vol. IV, pages 1–116.
Vol. V, all after Heft 6.
Vol. VI, all after Heft 2.
Vol. XI, all after Heft 2.
Verhandlungen :
1867, pages 113–203 and Title-page.
1869, Title-page.
1870, pages 93–173.
1871, " 87–107.
1874, " 329–377.

* The Society will be pleased to receive as donations any of the publications mentioned in this list.

1882, pages 190–206.
1883, " 1–98.
1884, " 1–52.

Akademie der Wissenschaften, Vienna.

Sitzungs (Phil. Hist. Cl.) :
Vols. I, II, III.
Vol. VIII, all after Heft 2.
Vol. IX, all except Heft 4.
Vol. X, all except Heft 5.
Vol. XVII, all after Heft 2 (if any).
Vol. XVIII, whole volume.
Vol. XIX, Heft 1.
Vol. LIV, whole volume.
Vol. CIV, Heft 1.
Sitzungs (Math.-Natur. Cl.):
Vols. I, II, III, IV, V, VI, VII, IX.
Vol. LXXXV, 1st Abth., Hefts 1, 2, 3.
Almanachs, all before 1855.
Registers :
(Phil. Hist. Cl.) all before 1854 and after 1879, 81 bis 90.
(Math. Natur. Cl.) all before 1854 and after 1880, 76 bis 80.

DENMARK.

K. Nordiske Oldskrift Selskab, Copenhagen.

Memoirs [1st Series], all before 1835.
[New Series], all between 1860 and 1866.
Aarböger, all before 1866.
Tillaeg till Arbögen, all before 1866.
Antiquarisk Tidskrift, all before 1843.
Annual Reports, all before 1834, also 1835, 1837 and all after 1839.

FRANCE.

Société Philomathique, Paris.

Bulletin :
[Old Series] any after Vol. III.
[New Series] all after 1824.
Extraits des Procès-verbaux, all except Séances de 1836–1838 (inclusive).

Société Ethnographique, Paris.

Mémoires, all after Tome II, 1845.
Bulletin, all except Tome 1re Année 1846.
Tome 1re Année 1847.

Société d'Histoire Naturelle de Strasbourg.

Mémoires :

Tome IV, 1re Livraison.
Tome V, 1re Livraison.
And all after Tome VI. 2.

Bulletin :

1re Année, No. 2.
2d Année all after No. 7, and the succeeding années.

Société des Sciences Naturelles and Archéologiques de la Creuse, Guéret.

Mémoires, all except Tome V, and all other publications of the society.

Société Americaine de France, Paris.

Archives [Old Series], all except Tome 1er, 1857–1859, pp. 1–32.
[Nouvelle Série] Tome I.
Tome III, Parts 1 and 2.
Tome IV, all after Part 3.
Tome V, Parts 1, 2, 3.
Tome VI, and all after to date.

Annuaire, all before and after 1873 to 1880 (inclusive); 1884 to date.

JAVA.

Bataviaasche Genootschap van Kunsten en Wetenschappen, Batavia.

Verhandlungen, XVI D, XVIII D to XXII D (inclusive).

Tidschrift voor Indische Taal-, Land- en Volkenkunde :

[N. S.] Deels I, II, III, 2 afl., and any after 6 afl.
[3e S.] Deel I, afl. 3, and any after 4 afl.
Deel II, afl. 1.
[6e S.] Deel I, Title-page and Index.

Register op de Notulen, all except 1867 to 1878.

Catalogus der Bibliotheek, any before 1864, and after except 1877.

Catalogus Numismatische afdeeling, all except 1869, 1877.

Catalogus Ethnologische Afdeeling, all except 1877.

Catalogus Numismatische Verzameling, all except 1886.

Catalogus der Archeologische Verzameling, all except 1887.

NETHERLANDS.

Bataafsch Genootschap van Proefonder vindelijke Wijsbegeerte, Rotterdam.

Nieuwe Verhandelingen, all after II Reeks ; III Deel, 2 Stuk. 1885 to date.

Programme, any before 1861 ; also 1862, 1864–1868 (inclusive), 1870, 1871, 1873, 1875, 1877–1879 (inclusive), 1881, 1883, 1885.

K. Zoologisch-Botanische Genootschap, 's Gravenhage.

Verslag-jaar, all before 1885, and any other publications of the society.

Hollandsche Maatschappij der Wetenschappen, Haarlem.

Verhandelingen, all before XXX Deel, 1754, and any after 1793.

Naturkunde Verhandelingen :

[1st Ser.] any after XX, 1833.

[2nd Ser.] III, 2 ; V, 2 ; VII ; IX ; XI, 2 ; XII ; XX ; and any after XXV.

[3rd Ser.] II, 1, 2 ; III ; IV, 2, and all after Part 3.

Programmes, any before and after 1867 to 1873 (inclusive), 1875, 1877, 1878, 1881.

Archives Ne'erlandaise :

Tome VIII, 1, 2, 5.

Tome IX, 1, 2, 3.

Tome XIII, 4, 5.

Tome XVI, 3, 4, 5.

Tome XIX, 3.

Nederlandsche Botanische Verein, Nijmegen.

Nederlandsche Kruidkundig Archief, all before Deel IV ; also Deel IV, 1.

[2 Ser.] Deel I, 1 ; II, 4 ; III, 1 ; IV, 1, 2.

RUSSIA.

Impériale Société des Naturalistes, Moscow.

Bulletin, Vols. II–VIII (inclusive), and any of that series after Vol. IX, 1837.

[N. S.] 1839, 1842, 1843.

1851, 1.

1858, 2, 3, 4.

1859, 1.

1861, 1862, 1863, 1864, 1.

Nouveaux Mémoires, Vols. I, II, III, V, VI, VIII, IX, XIII, 1 ; XIV, 3.

SWEDEN.

R. Societatis Scientarum Upsaliensis, Upsal.

Nova Acta [Ser. 1], Vols. IX, XI, and any after XII.

Académie Royale des Sciences, Stockholm.

Oversigt, 1848, No. 4.

Handlinger, Tome III, Trimestre for July, August, September, 1872.

Tal hallet vid præfidii nedlaggen uti K. Ved. Akad., all before 1839, also 1840, 1844–1848 (inclusive), 1850–1855 (inclusive), and any after 1856.

Lists of Members, all before 1861, also 1870, 1871, 1876, 1877.

[*To be continued.*]

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New Members Elected.

May 17, 1889.

No. 2156. Lester F. Ward . . . . . Washington, D. C.
2157. Andrew A. Blair . . . . . Philadelphia.
2158. Clarence H. Clark . . . . . Philadelphia.
2159. Henry D. Gregory . . . . . Philadelphia.

October 18, 1889.

No. 2160. Walter J. Hoffman, M.D . . . . . Washington, D. C.
2161. J. W. Powell . . . . . Washington, D.C.
2162. G. Brown Goode . . . . . Washington, D. C.
2163. Lyon G. Tyler . . . . . Williamsburgh, Va.
2164. James B. Angell . . . . . Ann Arbor, Mich.
2165. Henry Hazlehurst . . . . . Philadelphia.
2166. David K. Tuttle . . . . . Philadelphia.

December 20, 1889.

No. 2167. Dr. Friederich S. Krauss . . . . . Vienna.
2168. Sir George G. Stokes . . . . . London.
2169. Rt. Rev. John J. Keane . . . . . Washington, D. C.
2170. Dr. Charles C. Abbott . . . . . Trenton, N. J.
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him the communication, description, or model, except the officer to whom it shall be entrusted; nor shall such officer part with the same out of his custody, without a special order of the Society for that purpose.

6. The Society, having previously referred the several communications from candidates for the premium, then depending, to the consideration of the twelve counsellors and other officers of the Society, and having received their report thereon, shall, at one of their stated meetings in the month of December, annually, after the expiration of this current year (of the time and place, together with the particular occasion of which meeting due notice shall be previously given, by public advertisement) proceed to final adjudication of the said premium; and, after due consideration had, a vote shall first be taken on this question, viz.: Whether any of the communications then under inspection be worthy of the proposed premium? If this question be determined in the negative, the whole business shall be deferred till another year; but if in the affirmative, the Society shall proceed to determine by ballot, given by the members at large, the discovery, invention or improvement most useful and worthy; and that discovery, invention, or improvement which shall be found to have a majority of concurring votes in its favor shall be successful; and then, and not till then, the sealed letter accompanying the crowned performance shall be opened, and the name of the author announced as the person entitled to the said premium.

7. No member of the Society who is a candidate for the premium then depending, or who hath not previously declared to the Society, that he has considered and weighed, according to the best of his judgment, the comparative merits of the several claims then under consideration, shall sit in judgment, or give his vote in awarding the said premium.

8. A full account of the crowned subject shall be published by the Society, as soon as may be after the adjudication, either in a separate publication, or in the next succeeding volume of their Transactions, or in both.

9. The unsuccessful performances shall remain under consideration, and their authors be considered as candidates for the premium for five years next succeeding the time of their presentment; except such performances as their authors may, in the meantime, think fit to withdraw. And the Society shall annually publish an abstract of the titles, object, or subject matter of the communications, so under consideration; such only excepted as the Society shall think not worthy of public notice.

10. The letters containing the names of authors whose performances shall be rejected, or which shall be found unsuccessful after a trial of five years, shall be burnt before the Society, without breaking the seals.

11. In case there should be a failure, in any year, of any communication worthy of the proposed premium, there will then be two premiums to be awarded the next year. But no accumulation of premiums

shall entitle the author to more than one premium for any one discovery, invention or improvement.

12. The premium shall consist of an oval plate of solid standard gold of the value of ten guineas. On one side thereof shall be neatly engraved a short Latin motto suited to the occasion, together with the words: "The Premium of John Hyacinth de Magellan, of London, established in the year 1788;" and on the other side of the plate shall be engraved these words: "Awarded by the A. P. S. for the discovery of———A.D.———." And the seal of the Society shall be annexed to the medal by a ribbon passing through a small hole at the lower edge thereof.

SECTION 2. The Magellanic fund of two hundred guineas shall be considered as ten hundred and fifty dollars, and shall be invested separately from the other funds belonging to or under the care of the Society, and a separate and distinct account of it shall be kept by the treasurer.

The said fund shall be credited with the sum of one hundred dollars, to represent the two premiums for which the Society is now liable.

The treasurer shall credit the said fund with the interest received on the investment thereof, and, if any surplus of said interest shall remain after providing for the premiums which may then be demandable, said surplus shall be used by the Society for making publication of the terms of the said premiums, and for such purposes as may be authorized by its charter and laws.

The treasurer shall, at the first stated meeting of the Society in the month of December annually, make a report of the state of said fund and of the investment thereof.

☞ Members who have not as yet sent their photographs to the Society will confer a favor by so doing.

☞ Please communicate any change of address or inaccuracy in name.

☞ A few sets of the Society's Transactions, New Series, 1818 to 1885, XVI vols., 4to, can be obtained from the Librarian. Price $80.00.